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The Great Basin Naturalist

Volume III, 1942

Vasco M. Tanner, *Editor*

Published at Provo, Utah, by
The Department of Zoology and Entomology
of Brigham Young University

79,665

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The Great Basin Naturalist

Vasco M. Tanner, *Editor*

C. Lynn Hayward, *Assistant Editor*

A journal published four times a year by the Department of Zoology and Entomology, Brigham Young University, Provo, Utah.

Manuscripts. Only original unpublished manuscripts, pertaining to the Great Basin and the Western United States in the main, will be accepted. Manuscripts are subjected to the approval of the editor.

Illustrations. All illustrations should be made with a view to having them appear within the limits of the printed page. The illustrations that form a part of an article should accompany the manuscript. All half-tones or zinc etchings to appear in this Journal are to be made under the supervision of the editor, and the cost of the cuts is to be borne by the contributor.

Reprints. No reprints are furnished free of charge. A price list for reprints and an order form is sent with the proof.

Subscription. The annual subscription is $1.50, (outside the United States, $2.00). Single number, 50 cents.

All correspondence dealing with manuscripts, subscriptions, reprints and other business matters should be addressed to the Editor, Great Basin Naturalist, Brigham Young University, Provo, Utah.

Reprint Schedule of The Great Basin Naturalist

	2 pp.	4 pp.	6 pp.	8 pp.	10 pp.	12 pp.	Each Additional 2 pp.
50 copies	$2.00	$3.50	$4.50	$5.50	$6.50	$7.50	.95
100 copies	3.50	4.50	5.50	6.50	7.50	8.50	
200 copies	4.75	5.75	6.75	7.75	8.75	9.75	
300 copies	5.75	6.75	7.75	8.75	9.75	10.75	

Covers: $5.00 for first 100 copies; $2.00 for additional 100 copies.

The Great Basin Naturalist

Published by the
Department of Zoology and Entomology
Brigham Young University, Provo, Utah

Volume III JUNE 15, 1942 No. 1

A NEW CYRTOPOGON (ASILIDAE, DIPTERA) FROM UTAH[1]

79,665

D. ELMER JOHNSON
Lava Hot Springs, Idaho

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Cyrtopogon albifacies Johnson, new species

Black; mystax white; mesonotal disc gray pilose; tarsi of male long, slender, last joint flattened, pollinose crossband entire on first abdominal segment. Length 15 mm.

Male: Facial gibbosity white pollinose; mystax solid white; two basal antennal segments black, faintly white pollinose, hairs mostly white, but several black ones on second segment; second segment two-thirds as long as first; third segment missing, hairs of front black, tuft of white ones on ocellar tubercle; the front is pollinose, but is greased; orbits broadly bordered above, behind, and below with black hair, hair posterior to this is luteus; palpi black, black haired. Prothorax gray pollinose, white haired. Mesonotal disc shining black, gray pollinose, markings are obscure; hairs moderately abundant, gray; patch of long, slender, black hairs on mesopleurae, a few white ones on the metasternum. Pleurae gray pollinose; trichostical pile mixed black and white. Scutellum gray pollinose, flat. Wings gray hyaline, veins dark brown. Halters, knob yellow, stalk black. Femora black, long white pilose, a few black hairs apically; tibiae black, fore and middle ones very narrowly tipped with reddish; pile and bristles of middle and hind pairs dark brown to black; bristles and forsal pile of fore tibiae black, long white pile ventrally; middle and hind tarsi black, with black bristles, pads golden brown; fore tarsi clear honey yellow, long slender, last segment very long, slender, flattened; long white pile ventrally on metatarus, bristles long, slender, black, claws black, pulvilli dark; claws of middle and hind tarsi slightly reddish basally; pulvilli and empodia yellow. Abdomen shining black, white pollinose cross-bands on posterior margins or segments 1—6, interrupted on sixth segment only; moderately long grayish white pile on sides of first segment, rest of abdomen with short black pile, long on sides of segments two and three; genitalia black, pile mixed dark and light.

Female: Front scantily gray pollinose; one or two black hairs in upper mystax. Hair of ocellar tubercle black. Antennae black, third joint broadest two-thirds of the distance from the base, style hair as long as third segment.

(1) Contribution No. 98 from the Department of Zoology and Entomology, Brigham Young University.

Pile of thoracic dorsum shorter, less abundant; geminate strips more pronounced, brownish. Light hairs of abdomen extend into second segment, more yellowish than in male. Cross-bands on segments 1—5; genital spines dark red.

This species is nearest *evidens* O. S., but differs in the obscureness of the markings on the thoracic dorsum, has gray pollen instead of brownish, and has white mystax instead of black.

Type Locality: Glacier Lake, Mt. Timpanogos, Utah. Elevation 10,600 feet. The holotype is a ♂ and was collected by Vasco M. Tanner in August, 1928. The allotype and one paratype are ♀♀ and were collected at the same locality in July, 1935, by Edwin T. Vest. All three specimens are in the entomological collection of the Brigham Young University. Dr. D. E. Hardy collected a female at the type locality on August 15, 1936, which has been designated as a paratype. This specimen is now in the S. W. Bromley Collection.

The following supplementary material was furnished by Dr. D. Elmo Hardy, after studying the holotype and allotype specimens.(2)

"This species is more closely related to *C. planitarsus* Wilcox and Martin, the males may be distinguished by the following characters: The mystax is entirely white haired with no vertical line of black hairs in the middle. The ocellar tubercle entirely white haired instead of black; the lateral tufts of long white hairs extend over the inner margins of the eyes. Mesonotum chiefly subopaque, the shining black of the ground color is largely obscured by rather thick gray pollen (the specimen has been degreased since Johnson wrote the original description); mesonotal markings gray pollinose not golden brown as in *C. planitarsus*. The hairs of mesonotum and scutellum white with a few darker hairs intermixed on posterior margin of scutellum; instead of entirely black as in the related species. One distinct, black, notopleural bristle on each side and three or more brownish yellow to black bristles present on the posterior calli; the original description of *planitarsus* states that there are no definite bristles on the thorax. The mesopleurae of *albifacies* are subshining instead of shining black and the hypopleurae (as interpreted in the Asilidae) have just a few dark hairs scattered through the white, not having brownish hairs above and yellowish below. The front tibiae have a dense mat of long white pile extending their entire length below, not with a dense fringe of black bristles and hairs.

(2) This species was described in 1936 by Mr. Johnson in "A Further Study of Utah Asilidae," a Master's thesis, submitted to the department of zoology and entomology of Brigham Young University. Since this description has never been published, it was decided that if the species was still undescribed that it should be published. With Mr. Johnson's permission, I submitted the type specimens to Dr. D. Elmo Hardy, an alumnus of this institution and a very capable student of the Diptera, for his study and opinion. After reviewing the recent literature on this genus, he reported that it is undoubtedly an undescribed species. He furnishes the following comments and drawings which we are pleased to include along with Mr. Johnson's description.—Editor.

"After degreasing the holotype the following characteristics are evident. The face and front are entirely silvery gray, the subshining black ground color is obscured by dense pubescence. The mesonotum is mostly grayed by the pollen (microscopic pubescence), with a pair of gray dorsocentral vittae and a median stripe extending longitudinally from the anterior margin beyond the transverse suture; with a broad lateral stripe extending from behind each humerus to the posterior calli, this gray area extends transversely along the hind margin of the humerus until it converges with a dorsocentral stripe. Hind margin and portions inside the vittae subshining. The posterior crossband of fifth abdominal tergum is interrupted medianly.

"The basitarsi are equal in length to the next three subsegments of front tarsi, the fifth subsegment is less than half the width of the first and slightly subequal to it in length; the fifth joint broadens gradually toward its apex (fig. I, 3).

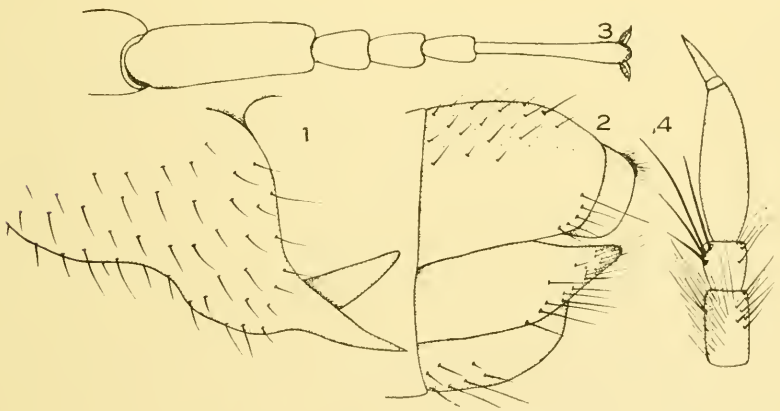

Fig. I. *Cyrtopogon albifacies* Johnson, new species. (1) Left clasper of ♂ ventral view; (2) Left lateral view of ♂ genitalia; (3) Hind tarsus of ♂ dorsal view; (4) Antenna of ♀. Drawings made by D. Elmo Hardy.

"Male Genitalia: Rather inconspicuous, not strongly produced. The ninth tergum is divided into two plates by a deep median cleft, the posterior margins of these plates very broad and rounding. The clasping structures are bilobed, produced into a slender pointed ventral lobe and a slightly shorter, more broad lobe arising on the inner surface of the main arm of the clasper and visible only from a ventral view (fig. I, 1); the outer lobe is yellow-red in color and the inner lobes shining black. The apical portion of each coxite appears obtuse from lateral view (fig. I, 2).

"FEMALE: This sex is distinguished from planitarsus by having the mesonotum, hypoleurae and abdomen as in male, abdominal segments six and seven shining black, not brownish. The female fits rather closely the description of the female specimen which Wilcox and Martin[3] doubtfully referred to *C. lineotarsus* Curran except that the mesonotum is largely grayish pollinose, only faintly shining and the antennal style is less than half the length of the third segment instead of about two-thirds its length as shown in Wilcox and Martin's figure of *lineotarsus* (fig. 1, 4)."

(3) 1936, Ento. Amer. XVI, 59-60.

American Association for the Advancement of Science

The twenty-sixth annual meeting of the Pacific Division of the American Association for the Advancement of Science will be held in Salt Lake City on June 15 to 20, 1942. A symposium on "The Great Basin, with emphasis on Glacial and Post-Glacial Times" has been arranged jointly by the American Association for the Advancement of Science and the American Society of Icthyologists and Herpetologists. The following papers will be given in the symposium: "The Geological Background," Elliott Blackwelder, Stanford University; "The Zoological Evidence," C. L. Hubbs and R. R. Miller, University of Michigan, Ann Arbor; and "Climatic Changes and Pre-White Man," Ernst Antevs, Globe, Arizona.

Many organizations such as the following will participate: Pacific Division of the American Association of Economic Entomologists; American Phytopathological Society; American Society of Ichthyologists and Herpetologists; American Society of Plant Physiologists; Botanical Society of America; Ecological Society of America; Society for Experimental Biology and Medicine; and Utah Academy of Sciences, Arts and Letters.

The local sponsoring organizations are: Utah Academy of Sciences, Arts and Letters; Utah State Agricultural College; Brigham Young University; Weber Junior College; and University of Utah.—V.M.T.

APHIDS FROM MOUNT TIMPANOGOS, UTAH[1]

GEORGE F. KNOWLTON
Research Associate Professor of Entomology
Utah Agricultural Experiment Station

The following report deals particularly with three apparently undescribed aphid species submitted to the writer for identification by Doctor C. Lynn Hayward of the Zoology and Entomology Department of the Brigham Young University at Provo, Utah.

Myzus haywardi Knowlton, n. sp. (fig I, 1-5)

ALATE VIVIPARA: Size 1.8 mm. long; body without definite color markings: antennal tubercles but moderately developed, diverging; antennae dusky to blackish beyond base of III, extending to beyond cornicles; antennal III, 0.54 mm. long with 19 to 23 sensoria; IV, 0.39; V. 0.3 to 0.32; VI, 0.125 to 0.14 + 0.53 to 0.54 mm.; rostrum reaching second coxae; rostral IV + V (fig. 4), 0.095, obtuse; hind tibiae 1.54; hind tarsi (fig. 5) 0.158 mm. long; cornicles pale, cylindrical, 0.395; cauda pale, 0.22, with 3 hairs on each side.

COLLECTION: On *Galium* or *Rudbeckia*, Big Tree Camp, Mt. Timpanogos, Utah, June 7, 1940.

TAXONOMY: This aphid keys to *Myzus scammelli* Mason in the Mason (U. S. Dept. Agr. Misc. pub. 371: 5, 1940) key, from which it differs in: Head with more distinct antennal tubercles, more sensoria on longer antennal III, longer unguis, cauda lacking a definite constriction. In Gillette and Palmer's key (Ann. Ent. Soc. Amer. 27: 201, 1934) *haywardi* runs to *M. mahaleb* Koch (= *lythri* (Schr.)) from which it differs in having more elongate cauda, more sensoria on a longer antennal III, and shorter cornicles.

Key to Aptera of the *Mac. albifrons* Group

1. Cornicles black ..... *zionensis* K.
   Cornicles pale 2

2. Cauda slightly constricted before base ..... *timpanogos* n. sp.
   Cauda tapering 3

3. Antennal III of aptera with 20 to 45 sensoria ..... *albifrons* Essig
   Antennal III of aptera with 5 to 17 sensoria ..... *thermopsaphis* K.

(1) Contribution from the Entomology Department, Utah Agricultural Experiment Station, Logan.

Macrosiphum timpanogos Knowlton, n. sp. (fig. 1, 6-9)

APTEROUS VIVIPARA: Color pale; size large, 4.1 to 5 mm. long; abdomen 2.75 wide; width through eyes 0.74; ocular tubercles present; rostral IV + V (fig. 6), 0.17; antennae 5.75 mm. long, pale to dusky, darker beyond middle of V; antennal III, 1.23 to 1.26 mm. long, with 11 to 22 sensoria (average 16); IV, 0.95 to 1.21; V, 1.03 to 1.09; VI, 0.24 to 0.25 + 1.64 to 1.7 mm. long; pleural margins of thoracic segments rugulose; cornicles pale, darker at tip, 1.11 to 1.22 mm. long with distal 0.9 to 0.11 reticulated; cauda pale, 0.63 to 0.65 mm. total length, slightly constricted before base with about 5 pairs of lateral hairs; hind tibiae 3.8 to 3.95; hind tarsi 0.24 mm. long.

COLLECTION: Host? (Probably from a lupine of some kind). At Hidden Lake Camp, Mt. Timpanogos, Utah, July 23, 1940.

TAXONOMY: *Macrosiphum timpanogos* n. sp. differs from *M. zionensis* Knlt. in having pale rather than black cornicles, more sensoria on antennal III, has longer unguis, cornicles; averages fewer sensoria on antennal III, has longer antennal V, cauda, hind tibiae and body than *M. albifrons* Essig. It differs from *M. thermopsaphis* Knlt. in

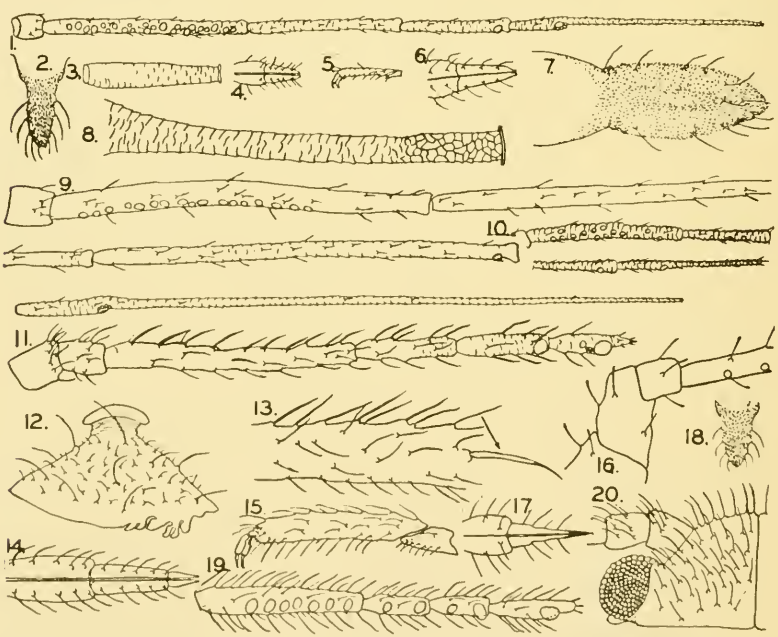

Fig. 1. *Myzus hayzvardi* n. sp., alate 1-5. *Macrosiphum timpanogos* n. sp., aptera 6-9. *Aphis ribiensis* G.-P., alate 10. *Cinara osborni* n. sp., aptera 11-15, 20. *Macrosiphum coweni* (Hunt.), aptera 16-17. *Flabellomicrosiphum tridentata* (Wil.), aptera 18. *Anoecia querci* (Fitch), alate 19.

being larger in size, having longer antennae, longer rostral IV + V, and averages more sensoria on antennal III.

MACROSIPHUM STANLEYI Wilson

Specimens of this species were collected on *Sambucus microbotrys* at Big Tree Camp, Mt. Timpanogos, June 4, August 1 and 2, 1940, and Lost Lake, Uinta Mountains, in Utah, August 28, 1940.

Cinara osborni Knowlton n. sp.[2] (fig. 1, 11-15, 20)

APTEROUS VIVIPARA: Body 3.48 to 3.6 mm. long and 1.93 to 2.28 wide across the abdomen; head width 0.85 to 0.93 mm. through eyes; ocular tubercles (fig. 20) well developed; antennae 1.49 to 1.65, pale except distal ends of III, IV, V and most of VI which are darker; antennal III, 0.63 to 0.665, without sensoria; IV, 0.196 to 0.26; V, 0.2 to 0.265, without secondary sensoria; VI, 0.142 to 0.158 + 0.049 to 0.06 mm.; rostrum reaching mid-abdomen; rostral IV + V acute at tip, 0.315 mm. long; hind tibiae 2.53 long (fig. 13) largely pale; abdominal segments with broad pleural sclerotized areas with irregular margins and detached, small, broken off, sclerotized "islands"; body hairs abundant, 0.08 to 0.095; cornicles with broad bases, armed with both long hairs (0.14 mm.) interspersed with more numerous short, fine hairs (fig. 12); anal plate rounded, dusky.

COLLECTION. On *Pseudotsuga mucronata* at Aspen Grove, Mount Timpanogos, Utah, June 30, 1940.

TAXONOMY: This species runs to *Cinara solitaria* (G. and P.) in Gillette and Palmer's key (Ent. Soc. Amer. Ann., 24: 844, 1931). From this it differs in being larger in size, having longer hind tibiae and antennae, and relatively longer antennal III in proportion to length of IV and V. It differs from *Cinara pergandia* (Wilson) in possessing paler hind tibiae with less spine-like bristles, lacking secondary sensoria on antennal V, and in having well developed ocular tubercles.

Types for the present in the collection of the writer. Paratype of *Macrosiphum timpanogos* n. sp. in the insect collection of the Department of Zoology and Entomology, Brigham Young University.

Dr. Hayward also collected: *Macrosiphum stanleyi* Wilson on *Sambucus microbotrys*, *Macrosiphum crenicornum* S.-K., probably on *Geranium* and *Mindarus abietinus* Koch on *Pseudotsuga mucronata*. This latter species was probably accidental on this host.

Some aphids collected around the lower slopes and along highways of Mount Timpanogos by the writer include: *Anoecia querci* (Fitch)

(2) Named in honor of my distinguished Professor, Dr. Herbert Osborn. The writer is indebted to Professor M. A. Palmer for her suggestions concerning this species.

(fig. 19) on *Cornus stolonifera*, *Eulachnus agilis* (Kalt.) on *Pinus*, *Euceraphis gillettei* Dav. on *Alnus*, *Chaitophorus viminalis* Mon. on *Salix*, *Periphyllus negundinis* (Th.) on *Acer negundo*, *P. populicola* (Thos.), *Clavigerus salicis* (L.) and *C. bicolor* (Oest.) on *Salix*, *Aphis artemisicola* Wms. on *Artemisia tridentata*, *A. frangulae* Kalt. on *Nepeta cataria*, *A. gregalis* Knlt. on *Chrysothamnus viscidiflorus*, *A. helianthi* on *Helianthus*, *A. ribiensis* G.-P. (fig. 10) and *A. varians* Patch on *Ribes*, *Cavariella capreae* (Fab.) on *Salix*, *Epameibaphis frigidae* Oest. on *Artemisia*, *Flabellomicrosiphum tridentatae* (Wils.) (fig. 18) on *Artemisia tridentata*, *Microsiphum artemisiae* (Gill.) on *Artemisia vulgaris* and *A. tridentata*, *Amphorophora nervata* (Gill.) on *Rosa*, *A. ribiella* (Dav.) on *Ribes*, *A. rubicola* (Oest.) on *Rubus*, *A. sonchi* (Oest.) on *Ribes*, *Capitophorus glandulosus* (Kalt.) on *Artemisia*, *C. gregarius* Knlt. and *C. oestlundi* Knlt. on *Chrysothamnus nauseosus*, *Kakimia cynosbati* (Oest.) on *Ribes*, *Macrosiphum coweni* (Hunt.) (figs. 16-17) on *Artemisia*, *M. packi* Knlt. on *Chrysothamnus nauseosus*, *Thecabius populi-monilis* (Riley) in bead-like leaf galls of *Populus angustifolia*, and *Forda olivacea* Rohwer on grass roots.

THE GENUS HESPEROTETTIX IN UTAH

(Orthoptera, Locustidae, Cyrtacanthacrinae)

W. W. HENDERSON
Professor of Zoology and Entomology
Utah State Agricultural College

I—HESPEROTETTIX IN GENERAL

Hespero = western; *tettix* = grasshopper.

This genus was set up by Scudder in 1876 to include a new species, *viridis,* previously described by Thomas and assigned by him to the genus Caloptenus.

Scudder's original description of the genus Hesperotettix (4: 262) includes the following:

"Head not very prominent; vertex very narrow between the eyes, with a light median pit; the fastigium broadening considerably in front, declivent, shallowly sulcate in the middle, the sides rounded... The frontal costa equal, scarcely contracted at the extreme summit."

His later description of the genus (11: 55-56) adds:

"Body almost parallel sided, very little enlarged at the metathorax, more or less but not greatly compressed... Pronotum long and slender, the dorsum fully half as long again as broad, the prozona the longer, sometimes half as long again as the motozona... Subgenital plate of male furnished with a prominent, subapical, more or less conical tubercle, the lateral margins of the plate suddenly ampliate at base; furculae always distinctly present as a pair of projecting lobes."

These descriptions point out the more evident features which characterize the genus Hesperotettix. It may be added that all the Utah species are decidedly greenish in color, if specimens are not too old and faded, and are marked with a color pattern streaked with white or yellow. Rehn and Hebard (19: 159-160) found species of this genus living on and among rabbit weed, *Isocoma heterophylla.* All of the Utah species are found conspicuously connected with snakeweed, or matchbrush, (Gutierrezia). The soil in which this plant grows is good for agricultural usage, but is often too dry for the raising of crops without irrigation. Where crops are grown in or near lands covered with Gutierrezia, these crops are often infested with species of Hesperotettix, especially *H. viridis* (Thomas).

Three species of the genus are plentiful in Utah. In *H. viridis* (Thomas) the tegminae and wings are fully developed, reaching to the end of the abdomen when folded and at rest. In *H. pacificus*

Scudder and *H. curtipennis* Scudder, the tegminae and wings are vestigial.

In *pacificus* the tegminae are bluntly rounded at the tip and are short, only a third the length of the abdomen or less; in *curtipennis* the tegminae are narrowly rounded or pointed at the tip and more elongate, commonly about half as long as the abdomen, though sometimes a little shorter than this. Three other species or races are said to exist in Utah but are not represented in Utah collections.(1)

II—HESPEROTETTIX VIRIDIS Thomas. Pl. I, fig. 1.

1. Synonymy:

1. 1872—Thomas, *Caloptenus viridis,* U. S. Geol. Survey Rep. Mont. Adj. Terr., p. 450.
2. 1873—Thomas, *Ommatolampis viridis,* Syn. Acrid. No. Amer., p. 156.
3. 1873—Thomas, *Ommatolampis viridis,* U. S. Geol. Survey Sixth An. Rep. Terr. Mont. Idaho, Wyo. Utah, pp. 724-5.
4. 1875—Scudder, *Ommatolamphis viridis,* U. S. Geol. Survey Rep. Terr. 100 Mer., pp. 506-7.
5. 1876—Scudder, U. S. Geol. Survey Bul. Terr. 11, p. 262.
6. 1883—Bruner, U. S. Ent. Com. III. Rep., p. 59.
7. 1897—Scudder. U. S. Nat. Mus. Proc. 20, pp. 55-56.
8. 1897—Lugger, Minn. Agr. Exp. Sta. Bul., pp. 266-267.
9. 1904—Rehn, Acad. Nat. Sci. Phila. Proc., p. 570.
10. 1931—Hebard, Acad. Nat. Sci. Phila. Proc. 83, p. 173.

2. Description:

The description given here is based on more than two hundred specimens collected from June 13 to September 27, from many different localities in Utah, and all from arid lands. The species is rather small in size, slender in form, bright green to greenish brown in color and streamlined with thin whitish or yellowish longitudinal streaks.

The face is noticeably slant, especially in males. Vertex very narrow between the eyes, but expanding quickly and widely immediately in front of the eyes. Sulcation of the vertex conspicuous, but nearly pinched out at the narrowest portion. Frontal costa wider than the narrowest portion of the vertex, sulcate throughout and slightly narrowed immediately below the ocellus. Compound eyes large, twice or more the length of the genal groove and directed distinctly forward at the tip, especially in males.

Pronotum cylindrical above; lateral and median carinae obliterated or nearly so, the median carina striped with a whitish line which arises on the occiput, bordered on each side with blackish, and extending to the tip of the metazone. A whitish line more or less indistinct arises on the margin of the occiput against the compound eye and

(1) Determinations of Utah material has been confirmed by Hebard to whom we are greatly indebted for extensive assistance.

passes along the humeral angle to the metazone and down the humeral angle of the tegmina, this stripe more or less obscure, and in places entirely obliterated in some specimens. Tegminae and wings pellucid and extending to the tip of the abdomen; tegminae streaked longitudinally with thin white lines at the lower edges, the humeral angles and the center, obscure or even obliterated in some individuals apparently older and worn.

Hind femorae elongate and slender, reaching to the tip of the abdomen in females, beyond in males, often tinged with pinkish and often with a pink annulus just above the knee. Hind tibiae with a bluish tinge in most specimens, obscure brownish in some.

It seems apparent that the coloration of this species follows that of the vegetation on and among which it lives. The vegetation is generally green when most of the individuals come to maturity, but fades out to greenish brown and later to brownish as the dry season advances. Specimens are green if captured when they are so young as to show little wear, but are mostly brownish if captured when they are older and much worn. Color evidently fades out on the insects as it does on the vegetation.

Cerci broad at base, narrowing to half the width of the first third, or first half and extending as an elongate cone to the pointed tip. Tubercle of the subanal plate well developed, but scarcely rising above the margin and extending caudad.

3. Measurements:

Male:

		mm.
Body length	(average for 100 specimens)	16.70
	shortest body in 100 specimens	13.00
	longest body in 100 specimens	20.00
Hind femora	(average length for 88 specimens)	10.00
	shortest length for 88 specimens	9.00
	longest length in 88 specimens	12.00
Tegminae	(average length of 93 specimens)	12.50
	shortest length in 93 specimens	10.00
	longest length in 93 specimens	15.00

One specimen shows a tegmina length of 7.00 mm.

Female:

		mm.
Body length	(average for 100 specimens)	21.61
	shortest body in 100 specimens	19.00
	longest body in 100 specimens	27.00
Hind femora	(average length for 98 specimens	12.00
	shortest length in 98 specimens	10.00
	longest length in 98 specimens	14.00
Tegminae	(average length for 65 specimens)	15.00
	shortest length in 65 specimens	12.00
	longest length in 65 specimens	19.00

4. Geographical Distribution:

This species was first known in Colorado, Wyoming and Kansas (1: 450). A year following the original description, that is in 1873, (2: 156) Thomas added Nebraska to the territory in which the species was then known. In 1876 Scudder (4: 262) added Utah and California (5: 506). In 1883, Bruner (8: 59) gave the geographical distribution of the species as "Utah, Colorado, Nebraska, Minnesota, Kansas & C." Scudder added New Mexico, Texas, Arizona, New Jersey, Iowa and Nevada in 1897 (11: 57-59). There is probably some error in regard to New Jersey. In 1908, Bruner (18: 315) recorded "Hab. North America, Southern States, Mexico," which probably covers a little too much territory. Hebard recently finds the species in South Dakota (23: 98), Montana (24: 266), Alberta, Canada (26: 393) in addition to previous records.

This species has been found to be "the most abundant species on the plains of eastern Colorado" (25: 372). It is also numerous in Utah on range lands where species of Gutierrezia plants are found and on many dry farms where Gutierrezia once thrived.

The present distribution, therefore, may be near correctly stated as Great Plains from Canada to Mexico and westward to California.

The species has been collected in Utah by Henderson in the following counties: Juab, Kane, Rich, Salt Lake, Summit, Uintah, Wasatch, Washington, and Wayne. In other counties in the state it has been taken as follows: Cache County by King, Harmston, Knowlton, Nye, Stafford and Thatcher; Box Elder County by Janes, Henderson, Knowlton and Smith; Utah County by Henderson, Knowlton, and Thornley; Davis County by Henderson, Knowlton, and Thornley; Grand County by Hammond, Henderson and Knowlton; Duchesne County by Harmston, Stains and Stoffers; Garfield County by Hammond; Emery County by Harmston; Carbon County by Knowlton; Millard County by King, Hanson, Henderson, Sorenson and Thornley.

III — HESPEROTETTIX PACIFICUS Scudder. Pl. I, fig. 2.

1. Synonymy:

1. 1898—Scudder, U. S. Nat. Mus. Proc. XX, pp. 61-62.
2. 1904—Bruner, Col. Agr. Exp. Sta. Bul. 94, p. 63.
3. 1910—Kirby, Syn. Cat. Orth. III, p. 499.

2. Description:

Body sparsely covered with fine short hair extended over head, legs and tegminae; general color brownish to greenish with darker and

lighter marking, brown more prevalent among specimens than green.

Head with median dark patch or stripe, which is penetrated through the center with a white median streak; face very slant.

Vertex sharply narrowed between the apex of the eyes to distinctly less than the width of the frontal costa, and expanding sharply in front to more than the width of the frontal costa; lateral carinae of the fastigium nearly or totally confluent in the narrowest portion with a scarcely elongate sculcus or pit behind the confluence and a shallow but broader sulcation in front.

Frontal costa fairly straight, narrow and rather deeply sulcate for its entire length.

Pronotum dimly striped lengthwise with two lateral and one median whitish and darker stripes, the post-ocular blackish band located between the two lighter lateral stripes, the latter stripes ending at the main transverse incision, but the median, edged with darker, or black continues to the end of the posterior lobe. Pronotum much rounded from one lateral lobe to the other so that lateral and median carinae are scarcely or not at all evident.

Tegminae short, only about one-fifth the length of the abdomen, nearly as broad as long with tip broadly rounded in females, more narrowed and elongate in males. Wings much smaller, only about one-fourth as large as the tegminae. Hind femorae varying in color among specimens from light brown to greenish, outer face darker, little or no tendency to banding on outer face, but slight tendency to banding on upper and inner faces in some specimens. Hind tibiae also varying in color as the hind femorae, with tendency to greenish in most specimens, spines colored as the tibiae and tipped with black. Abdomen brownish or slightly greenish, not much marked with any contrasting color, and with tendency to show median dorsal carina. Cerci broad at base but narrowing quickly from both sides to an elongate tip. Subanal plate of the male with central tubercle arising behind and elevated above the dorsal margin.

3. Measurements:

Male:

		mm.
Body length	(average for 10 specimens)	15.10
	shortest body in 10 specimens	14.00
	longest body in 10 specimens	16.00
Hind femora	(average for 8 specimens)	8.20
	shortest in 8 specimens	8.00
	longest in 8 specimens	9.00
Tegminae	(average for 10 specimens)	3.60
	shortest in 10 specimens	3.00
	longest in 10 specimens	4.00

Female:

		mm.
Body length	(average for 23 specimens)	20.34
	shortest in 23 specimens	18.00
	longest in 23 specimens	24.00
Hind femora	(average for 17 specimens)	11.00
	shortest in 17 specimens	9.00
	longest in 17 specimens	13.00
Tegminae	(average for 23 specimens)	5.00
	shortest in 23 specimens	4.00
	longest in 23 specimens	6.00

4. Geographical Distribution:

Hesperotettix *pacificus* was described by Scudder from two males and eight females all of which were taken in southern California (11: 62). He says that "Koebele reports it from the Shasta district in Northern California." Utah is apparently the only other state in which the species is known. The Utah collection consists of 11 males and 25 females, all taken in desert regions of the southern portion of the state since 1920. More specific collection data follow: Garfield County, Gardner; Washington County, Rowe; Iron County, Gardner and Hammond; Beaver County, Gardner, Hammond and Tanner; Millard County, Hammond. The species is of no economic importance, although it is probably more abundant and more widespread than the few specimens actually collected would indicate.

IV — HESPEROTETTIX CURTIPENNIS Scudder. Pl. I, fig. 3.

1. Synonymy:

1. 1898—Scudder, U. S. Nat. Mus. Proc. XX, pp. 62-63.
2. 1904—Bruner, *H. coloradensis*, Colo. Agr. Exp. Sta. Bul. 94, p. 63.
3. 1905—Caudell, U. S. Nat. Mus. Proc. XXVIII, pp. 465-466.
4. 1910—Kirby, Syn. Cat. Orth. III, p. 499.
5. 1925—Hebard, Acad. Nat. Sci. Phila. Proc. LXXXI, p. 374.
6. 1935—Hebard, Amer. Ent. Soc. Trans. LXI, pp. 301-302.

2. Description:

Body sparsely covered with fine, short hair, extended over head, legs and tegminae; general color olive gray or brownish gray to bright green with darker and lighter markings, greenish more prevalent among specimens than brownish.

Head with median dark stripe or patch, sometimes nearly as broad as the summit, and often containing a faint light stripe; face distinctly slant.

Vertex sharply narrowed between th apex of the eyes, to distinctly less than width of the frontal costa, and expanding in front to more than the width of the frontal costa, the edges of the fastigium nearly

confluent at the narrowed point, a scarcely elongate narrow sulcation or pit behind the confluence and a very shallow but broader sulcation in front.

Frontal costa, fairly straight, narrow and rather deeply sulcate for its entire length.

Pronotum distinctly striped lengthwise with one median and two lateral whitish and greenish or lighter and darker stripes, the post-ocular greenish or blackish band located between the two lateral ones

Plate I

Fig. 1. *Hesperotettix viridis* (Thomas); fig. 2. *Hesperotettix pacificus* Scudder; fig. 3. *Hesperotettix curtipennis* Scudder.

terminate with the main transverse incision, but the median stripe, edged with darker color, continues to the tip of the posterior lobe. Median and lateral carinae of the pronotum scarcely visible, the pronotum rounded from side to side. Three transverse incisions well impressed, the posterior most conspicuous, the other two sinuous with the middle incision closer to the one in front than the one behind it. Posterior lobe about three-fourths as long as the anterior and very broadly rounded at the tip.

Tegminae about twice as long as broad, one-third to one-half as long as the abdomen, narrowly tipped, greenish or olivaceous in color; wings nearly as long as the tegminae.

Hind femorae about the same color as the body, the outer face darker or even blackish, inner face lighter, in some specimens slightly ruddy. Hind tibiae green, varying from a slight hue to a brilliant light green, tibial spines whitish or greenish tipped with black. Abdomen yellowish brown to greenish, marked generously with darker patches, and with a rather distinct median carina. Cerci broad at base and tapering from both sides to an elongate tip, the cerci smaller in females. Subanal plate of the male with central tubercle arising behind and elevated above the hind margin.

3. Measurements:

Male:

		mm.
Body length	(average for 31 specimens)	15.50
	shortest body in 31 specimens	13.00
	longest body in 31 specimens	18.00
Hind femora	(average for 26 specimens)	9.50
	shortest femorus in 26 specimens	8.00
	longest in 26 specimens	10.00
Tegminae	(average for 31 specimens)	5.00
	shortest in 31 specimens	3.00
	longest tegmina in 31 specimens	7.00

Female:

		mm.
Body length	(average for 63 specimens)	20.33
	shortest in 63 specimens	15.00
	longest in 63 specimens	24.00
Hind femora	(average for 58 specimens)	11.00
	shortest in 58 specimens	10.00
	longest in 58 specimens	13.00
Tegminae	(average for 63 specimens)	7.00
	shortest in 63 specimens	5.00
	longest in 63 specimens	10.00

4. Geographical Distribution:

The original description by Scudder (11: 62) was based on two females taken in Colorado. Caudell obtained two females and one

male a few years later in southern Arizona (15: 465) and described the male of the species from this one specimen. In 1929 Hebard (25: 374) obtained a large series from Colorado and New Mexico to bring the distribution of the species to the three states named. The Utah collection contains 31 males and 63 females collected as follows: Summit, Duchesne, Juab, Millard, Sevier, Piute and Emery Counties by Henderson; Beaver by Henderson and Knowlton; Wayne by Gardner and Henderson; Garfield by Gardner, Hammond and Henderson.

V—OTHER HESPEROTETTIX IN UTAH

H. festivus Scudder. Scudder described this species in 1897 (11: 60) from a single male specimen taken at "Lake Point, Salt Lake" by Packard in 1875, and which Scudder has previously referred to as *H. viridis* Thomas (4: 262). He also referred to this species, one specimen "from Mt. Nebo, Utah, taken in August, and one from Spring Lake" recorded in a paper by Thomas in 1876 (6: 262). A record which Bruner makes of *H. viridis* (Thomas) in Utah in 1883 (8: 58) is also referred to by Scudder as *H. festivus*.

In connection with his description of *H. festivus*, Scudder notes 66 males, 58 females, names four places in Utah and then Los Angeles County, California. How many of these 124 specimens were taken in Utah is not disclosed. In 1904 Bruner (13: 62) records *H. festivus* for Colorado and includes this remark: "Hind femora without red pregenicular annulation or only faint signs of one," which seems to make this character an issue in distinguishing the species. Bruner would say that *H. festivus* must not have pregenicular red annuli. In the same year Rehn (14: 570) took five specimens in Arizona and says, "All five specimens posses reddish pregenicular annuli." Rehn says then, that *H. festivus* must have pregenicular red annuli. In 1906 (16: 400) Rehn and Hebard say they found the species on a "Hillside at Salt Lake City," "Top of Ensign Peak" and "This species was by far the most plentiful of the genus Hesperotettix which I found, and individuals were quite common in the sage growing from the foot to the top of Ensign Peak."

Again in 1907, Rehn (17: 73-77) took a male specimen at Tucson, Arizona and remarked, "This individual has the pregenicular annuli very distinct, but shows no traces of the black penciling of the pronotal sulci seen in *H. viridis*." This remark sustains red annuli for *H. festivus* and points out another important character, the absence of "black penciling of the pronotal sulci." Rehn and Hebard found 34 specimens of this supposed species in Arizona in 1908 (19: 393-394)

and remark: "Red pregenicular annuli on all but three specimens which are in, or approach the brownish stage."

We have before us 277 specimens of *H. viridis* (Thos.), 36 specimens of *H. pacificus* Scud. and 99 specimens of *H. curtipennis* Scud. Nearly all of these specimens show at least some trace of pregenicular red annulus and variability is exhibited from this trace through every stage of expression to very distinct. Rehn and Hebard (loc. cit.) hint the true significance of variability in pregenicular annulus. It is probably an age trait, and has no specific importance. We find this to be true also of "black penciling of the pronotal sulci." (Rehn and Hebard (loc. cit.). If species cannot be allowed reasonable variability, they can easily be multiplied in number so that species status would almost coincide with specimen status.

Although we have sought diligently, we cannot find *H. festivus* in Utah unless we partly close our eyes and pick it out somewhat carelessly from *H. viridis*. We not with satisfaction that Hebard recently said (24: 393) "*Festivus* must be considered a race of *viridis*." Evidence here would lead to the conclusion that in Utah, *festivus* is *viridis*.

H. viridis nevadensis Morse.

This supposed species was described by Morse in 1903 (12: 115) from three males and three females found in Nevada. This description is concerned largely with color variations which have little if any significance in discriminating the various species of Hesperotettix. Large series of *H. viridis* and *H. curtipennis* both include the variations given by Morse for *H. nevadensis*. Description of structural features mention the tegminae and wings as being "about one and one-third times as long as the exposed part of the abdomen." Morse gives the length of tegminae as 6.3 to 6.7 mm. for the male and 8.5 to 9 mm. for the female. Total length is given as male 16; female 21 mm. In the Utah series of *H. curtipennis* the tegminae length for 31 males varies from 3 mm, the shortest, to 7 mm, the longest, with the average of 5 mm. For females these figures are, shortest 5 mm, longest 10 mm, with average for 63 specimens of 7 mm. Body length of the Utah specimen shows an average of 15.50 mm for males and 20.33 for females. These measurements all coincide closely enough that no margin is left for species difference, so we find no place as yet for the *H. nevadensis* in Utah. Mr. Hebard helpfully gave the author a male and a female of *H. nevadensis* which he took at Kanosh, Utah. We cannot distinguish these from *H. curtipennis*.

H. nevadensis terminus Hebard.

Hebard (21: 163-166) described *H. nevadensis terminus* as a new geographic race, based on a few specimens taken in Utah and Nevada. His description for this race is similar to that of the very short, truncate tegminae of *H. pacificus* and runs very much like a description for it. Hebard (loc. cit.) also finds *H. nevadensis gillette* in Utah (loc. cit.).

The following species and races of Hesperotettix are known therefore in Utah:

H. viridis viridis (Thomas)
H. viridis nevadensis Morse
H. viridis gillette Bruner
H. viridis terminus Hebard
H. viridis festivus Scudder
H. pacificus Scudder
H. curtipennis Scudder

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Insect Food of the Rock Wren

The rock wren, *Salpinctes obsoletus obsoletus* (Say), is a common and sometimes abundant denizen of many rocky local semi-desert areas frequented by the sugar-beet leafhopper, *Eutettix tenellus* (Baker), the false chinch bug, *Nysius ericae* (Sch.), Say's plant bug, *Chlorochroa sayi* Stal, army cutworm, various grasshoppers, *Chorizagrotis auxilaris* (Grote), and certain other insects which move from range land to attack agricultural crops in the cultivated areas. During a season of unusual beet leafhopper abundance, as many as 59 *E. tenellus* have been found in the stomach of a rock wren collected near Timpie, Tooele County, Utah on October 6, 1934. Fifty-three adult and 11 nymphal *Nysius ericae* were present in the stomach of a specimen taken at Timpie on September 11, 1937, besides 16 *E. tenellus,* 2 mirids, *Lygus hesperus* Knt., 1 Coleoptera larva, 2 ants and 1 Lepidoptera larva. In 1940, with grasshoppers abundant, 22 of the 26 stomachs collected contained 51 grasshoppers, mostly adults. One stomach held 658 winged ants, besides parts of 1 grasshopper, an aphid, 1 beetle, 1 scutellerid bug and a beet leafhopper.

The total recognizable insect contents in the 88 stomachs examined, collected throughout Utah from 1935 through 1941, consisted of: 1 Thysanura; 10 Collembola; 104 Orthoptera, 92 being adult and 3 nymphal grasshoppers, among them being recognized *Melanoplus mexicanus* Sauss., *Camnula pellucida* (Scudder), *Chorthippus curtipennis* (Harris), *Trachyrhachis kiowa* (Thos.) and *Trimeritropus* spp.; 4 Isoptera; 3 Odonata, dragonflies; 5 Neuroptera included larval ant lions and 1 Raphidiidae; 11 Trichoptera; 418 Heniptera, 268 adult and 51 nymphal *Nysius ericae,* besides 5 *Geocoris decoratus* Uhl, 1 Scutelleridae, *Homaemus acnifrons* (Say), 48 Pentatomidae which included *Chlorochroa sayi, C. uhleri* Stal, *C. ligata* (Say) and *Thyanta custator* (Fabr.), 8 Miridae, 3 being *Lygus hesperus* and 1 *L. elisus* Van D. being recognized, 1 Anthocoridae, *Orius tristicolor* (Wh.), 1 Nabidae, *Nabis alternatus* Parsh; of 776 Homoptera, 326 were leafhoppers, 166 being adult and 152 nymphal *Eutettix tenellus,* with *Aceratigallia sanguinolenta* (Prov.) and *Dikraneura* sp. also represented; 1 Fulgoridae; 417 Aphididae, recognized among them being *Cinara sibericae* (G.-P), 12 *Macrosiphum cscalantii* Knlt., 2 *M. coweni* (Hunter), *Aphis carbocolor* Gill., *A. bonnevillensis* Knlt., and *A. medicaginis* Koch; 8 Coccidae; 3 of the 106 Coleoptera found were larave; the rest included 1 Carabidae, 6 Chrysomelidae (4 being flea beetles), 1 Buprestidae, 1 Scarabaeidae, and 2 Melyridae, *Collops bipunctatus* Say; 43 Lepidoptera, 17 being larvae, and in addition there were 45 lepidopterous eggs; 29 Diptera, one a *Pipunculus* sp. larva protruding from a beet leafhopper abdomen, besides 4 Culicidae, 4 Tipulidae, 1 Chironomidae, 1 Syrphidae, 1 Calliphoridae and 2 Tabanidae, 1 a *Chrysops fulvaster* O. S.; 1,171 Hymenoptera, 1,097 being ants including many *Pogonomyrmex occidentalis* (Cresson), 1 Braconidae and 1 wild bee. There also were found 51 miscellaneous insect eggs, 5 spiders, 1 large red mite, 1 Solpugida, and 30 seeds (mostly from weeds). A number of the stomachs held plant fragments, besides some extra grasshopper mandibles which may have been used as grit.

Because of its feeding so extensively upon injurious species of insects, the rock wren should be considered a beneficial and desirable inhabitant of the western range and farm lands.—George F. Knowlton and F. C. Harmston, Utah Agricultural Experiment Station, Logan.

STUDIES IN THE WEEVILS OF THE WESTERN UNITED STATES NO. V: A NEW SPECIES OF MILODEROIDES[1]

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Miloderoides vandykei Tanner, new species

FEMALE: Body robust, oblong, black, antennae club golden brown, vibrissae and setae yellowish brown, imbricate scales, white, black and brown interspersed, without a sheen which gives the body a dull appearance. Head one third longer than the prothorax; rostrum broad, the width two thirds the length, flattened above, with parallel sides, pronounced basal constrictions and with a well defined median longitudinal groove which is not covered with scales. The rostral sulcus terminates in a well developed frontal fovea. The subapical area slightly depressed and angular; the scrobes deep, terminating below the eyes which are slightly ovalute, black and prominent, the scape reaches beyond the middle of the eye. The first joint of the funiculus is longer than the third and fourth joints; the club is received in the cupped seventh funicular segment. Prothorax wider than long, (2.1 mm. : 1.9 mm.), the greatest width near the apical region; postocular lobes absent, vibrissae long reaching the eye; dorsal area tuberculate covered with black scales and brownish yellow setae which arise from the tubercules, lateral portion with a whitish vittae of scales. The elytra widest just before the middle; the surface flat; the striation and punctation obscured by the imbricate scales; the setae are similar in color and length on the rostrum, head, prothorax and elytra. There are two rows of scales on each elytral interval, and these arise in very small punctures. When the scales are removed the surface is black and shining. The setae of some of the males are longer and more dense than that of the females. This along with the expanded third tarsal segment distinguishes the males from the females. The legs are whitish except for the corbel spinules and the ventral tarsal spines which are black and the distal tips of the femora which are covered with black scales. The spinules of the tibial comb are more closely set and slightly longer than in other species of this genus. Before the tibial spine on the anterior leg there are 13 to 17 spinules. All the tibiae are mucronate; the ventral surface of the tarsal segments are covered with black spines in the females while the pad on the third segment is slightly silvery in color. The fourth segment is as long as the other three; the claws are widely separated and long.

The female genitalia is distinctive. The valvifer and coxite are not clearly separated, however, the styli are small but distinct. The eighth sternite is a helpful character in practically all the species of this and realted genera. The male genitalia differs from other species in this genus due to the size and shape of the median oriface (No. 2). Total length of the prothorax and elytra is 6.0 mm. to 7.4 mm.

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(1) Contribution No. 99, Department of Zoology and Entomology, Brigham Young University

Males: The male is similar to the female except the setae of the elytra are usually much longer and more dense, and the third tarsal segment is expanded and padded with a slightly silvery colored thick setae. The length of the males is 5.6 mm. to 7.0 mm.

Type Locality: The Virgin River at St. George, Washington County, Utah. The holotype, allotype and four paratypes were collected in 1892 by C. J. Weidt on the Virgin River south of St. George; and four paratypes were collected by Angus M. Woodbury at St. George in 1923. One paratype is being sent to each of the following: Dr. E. C. Van Dyke of the California Academy of Sciences, Mr. P. C. Ting of San Francisco, California, and to Mr. L. L. Buchanan of the U. S. National Museum, Washington, D. C. The remaining seven specimens are in the author's collection at Brigham Young University. The specimens collected by C. J. Weidt were in the Charles Leng collection. I am pleased to name the species in honor of Dr. Van Dyke who has done so much to promote the study of Entomology and especially the study of the Coleoptera of the Western United States.

Discussion: In the accompanying illustrations there are drawings of the corbel of the anterior leg of the three species of the genus Miloderoides. Number 3 shows the inner surface of the left corbel of *M. vandyki* with the tarsus removed. There are 13 to 17 spinules in the distal comb up to the tibial spine, then one or two spinule just below and a little in from the tibial spine, followed by a row of fine long setae and then 4 to 6 close set long spinules in the anterior comb. While the number of spinules are variable in the specimens of this species, there are more than in *maculatus*. In the two specimens of *maculatus* which I have examined the maximum number of spinules in the distal comb is 10 and in the anterior comb 3 to 4 (No. 5). In both of these species the spinules are black and long while in *cinereus* they are amber colored and most of the distal comb ones are short and blunt (No. 4).

In a previous paper[2] a drawing of the female genitalia of *M. vandykei* was reported as *Cimbocera buchanani*, due to a mixing of specimens of these two species. This should have been avoided, however, since the genitalia of the two genera are fundamentally different. This has been pointed out by Mr. Ting in his useful paper.[3] In order that I may correct this error a drawing of the genitalia of *buchanani* is included in this study. The genital structures of 4 speci-

(2) Tanner, Vasco M., 1941. Studies in the Weevils of the Western United States No. IV: A New Species of Cimbocera. Great Basin Nat. Vol. II, No. 1, pp. 29-32.

(3) Ting, P. C., 1940. Revisional Notes Concerned with Cimbocera and Related Genera. Bull. So. Calif. Acad. Sci., Vol. 39, Part 2, pp. 128-157.

mens have been studied. I now have 18 specimens of *buchanani* in the collection. These are from San Maroial, New Mexico (1 paratype from Mr. Ting); Santa Fe, New Mexico (1); El Paso, Texas (12 from the Charles Leng Collection); Peach Springs, Arizona (2 from Leng Collection); and Grand Junction, Colorado (2).

The structures which I have called the styli in *C. buchanani* and *petersoni* are considered as extensions of the coxites by Ting. From my observation of these structures they seem to be movable distinct structural units. In *buchanani* it appears that there is a baculum extending from the base of the stylus into the coxite. This in some specimens seems to be continuous with and a part of the coxite. By making a glycerine mount of these structures and studying them under a compound microscope these structures may be more readily observed. Here we have a different type of stylus to that found in

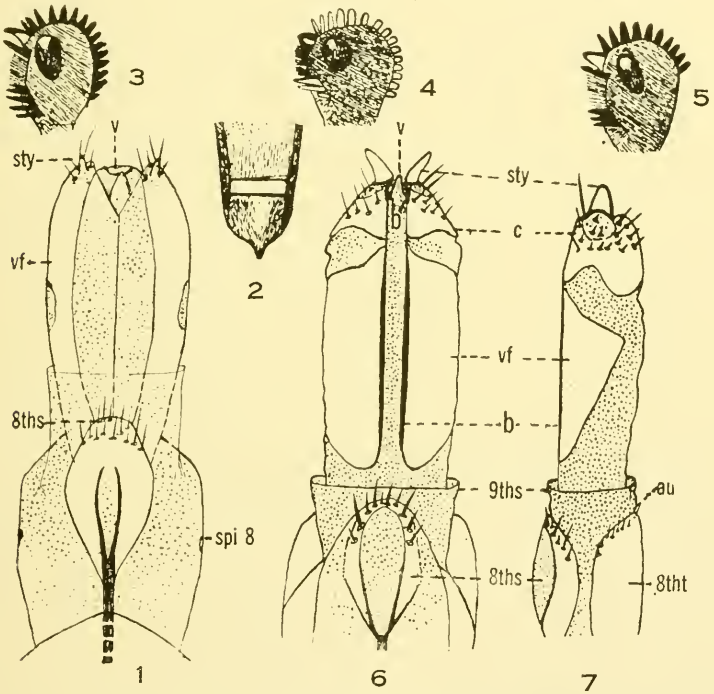

Figure 1. (1) Ventral view of the female genitalia of *Miloderoides vandykei*; (2) Male genitalia of *M. vandykei*; (3) Anterior corbel showing spinules of the distal and anterior combs of *M. vandykei*; (4) spinules of the combs on the anterior tibia of *M. cinereus*; (5) some of *M. maculatus*; (6) and (7) ventral and lateral view of the female genitalia *Cimbocera huchanani*. sty—stylus; vf—valvifer; 8ths—eighth sternite; spi 8—eighth spinacle; c—coxite; b—baculum; 9ths—ninth sternite; au—anus; v—vulva.

vandykei and many other weevils and familis of Coleoptera. In some of the Cicindelidae and Carabidae the styli are similar to what we have in this case. The structures called the styli in Cimbocera are not setiferous as usual, but they are movable and surrounded by setae which arise in both the membranous and sclerotized surrounding coxite. The styli in *buchanani* are longer and stand more erect than in *petersoni*. On several of the specimens there is a ventral inner sclerotization of the valvifer which constitutes a baculum, this is as Ting observed not so pronounced as in *pauper*. The eighth sternite is different from other species of Cimbocera which I have studied. The genitalia of *buchanani* and *petersoni* are similar in many respects but distinctive in others which renders them useful in classification.

Three species are now ascribed to the genus Miloderoides. They may be separated as follows:

(1) Rostrum without triangular shaped depression in subapical area. Corbel spinules black well spaced, 10 in distal comb; setae long, blackish and brownish on head, prothorax and elytra. Antenna club blackish, scales gray and dark brown mottled with a sheen; eighth sternite less sclerotized; size 5.7 mm. to 5.9 mm..... .....*maculatus* Van Dyke

Corbel spinules black fairly closely set, 17 in the distal comb; setae short, and golden on head, prothorax and elytra. Antenna club golden brown; scales white, gray and black intermixed without a sheen given a dull lead color; eighth sternite more sclerotized. Size 7.0 mm. to 7.6 mm.....*vandykei* new species

(2) Rostrum with subapical area depressed, triangular shaped. Corbel spinules, blunt amber colored. 15 in distal comb; setae short and golden; scales gray and reddish with a distinct sheen. Size 7.2 mm.....*cinereus* (Van Dyke)

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The Great Basin Naturalist

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Published at Provo, Utah, by the
Department of Zoology and Entomology of
Brigham Young University

The Great Basin Naturalist

Vasco M. Tanner, *Editor*

C. Lynn Hayward, *Assistant Editor*

A journal published four times a year by the Department of Zoology and Entomology, Brigham Young University, Provo, Utah.

Manuscripts. Only original unpublished manuscripts, pertaining to the Great Basin and the Western United States in the main, will be accepted. Manuscripts are subjected to the approval of the editor.

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Subscription. The annual subscription is $1.50, (outside the United States, $2.00). Single number, 50 cents.

All correspondence dealing with manuscripts, subscriptions, reprints and other business matters should be addressed to the Editor, Great Basin Naturalist, Brigham Young University, Provo, Utah.

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The Great Basin Naturalist

Published by the
Department of Zoology and Entomology
Brigham Young University, Provo, Utah

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A REVIEW OF THE GENUS NOTOLEPIDOMYZON WITH A DESCRIPTION OF A NEW SPECIES (PISCES-CATOSTOMIDAE)[1]

VASCO M. TANNER
Professor of Zoology and Entomology
Brigham Young University

In 1876 when Professor Cope[2] established the genus *Pantosteus* for the mountain suckers found in the Rocky Mountains and Great Basin he made *Minomus platyrhynchus* Cope the type of the genus. Species of this genus were said to differ from those of a closely related genus *Catostomus* by having the bones of the head thick with the parietals and frontals more or less united thus, in some instances, obliterating the fontanelle; also both jaws with cutting edges and lower lip not very deeply cleft.

Mr. Henry W. Fowler[3] in 1913 proposed that *Pantosteus arizonae* (Gilbert) be made the type of a new sub-genus *Notolepidomyzon;* since the

> "scales along predorsal region and back all well enlarged; less than twenty between occiput and origin of dorsal, and contrasting with the small scales in the lateral line."

It will be noted that Mr. Fowler's characterization of this subgenus is based upon the enlarged anterior scales of a single species in the Gila basin.

---

(1) Contribution No. 100, Department of Zoology and Entomology, Brigham Young University.

(2) Cope, E. D. and Yarrow, H. C., 1876. Report upon the Collection of Fishes made in Portions of Nevada, Utah, California, Colorado, New Mexico, and Arizona during the years 1871-2-3 and 4. Rept. Geog. and Geol. Expl. and Survey, West of the One Hundredth Meridian. Vol. V. Zoology pp. 635-703.

(3) Fowler, Henry W., 1913. Notes on Catostomoid Fishes. Proc. Acad. Nat. Sci. Phila., p. 47.

A comparative study of the species of the genus Pantosteus was made in 1916 by Professor J. O. Snyder[4] which resulted in his separating the species

> "into two well defined, natural groups, one characterized by a thick cranium in which the parietals and frontals meet in a close, strong suture, and another by a relatively thin cranium where parietals and frontals are separated by a long, often very narrow fontanelle which apparently does not close even in very old individuals."

For the first group Professor Snyder used the subgeneric name Notolepidomyzon of Fowler and for the second, Cope's Pantosteus. He assigned the following species to the genus Notolepidomyzon: *clarki, santa-anae, generosus,* and *plebeius.*. In 1932 the writer[5] added the species *utahensis,* and in this paper is described the sixth species of the genus *intermedius.* This leaves the following species in the genus Pantosteus: *platyrhynchus,* type of the genus; *delphinus; jordani, columbianus; viresceus;* and *lahontan.*

My study of the species of these genera supports the conclusion that Notolepidomyzon and Pantosteus represent natural genera characterized by definite characters and that they are, in the main, geographically separate. *Delphinus* is the only species of Pantosteus found in the Colorado River basin. A large series of this species should be studied in the light of our understanding of these genera. It is now known that Notolepidomyzon, as here considered, is not represented in the Great Basin fauna. According to the geographical distribution of the species of this genus the center of distribution for the complex is, undoubtedly, the Colorado River basin.

These genera may be characterized as follows:

> Lips will well defined cutting edges; cranium thin; no fontanelle; scales between the occiput and dorsal larger and usually less than on anterior lateral line; Colorado River basin and eastward in distribution ..... Notolepidomyzon
>
> Lips with well defined cutting edges; cranium thin; fontanelle poorly to well developed; median scales between occiput and dorsal small, about the same in number and size as on the anterior lateral line; mainly Great Basin and westward..... Pantosteus

A morphological study of the species of Notolepidomyzon has re-

(4) Snyder, John O., 1916. Notes on a collection of Fishes made by Dr. A. Mearns from rivers tributary to the Gulf of California. Proc. U. S. Nat. Mus. Vol. 49. pp. 473-586. 2 pls. In this paper Snyder illustrated the crania of several catostomids including Notolepidomyzon and Pontosteus.

(5) Tanner, Vasco M., 1932. A Description of Notolepidomyzon utahensis; a new Catostomid from Utah. Copeia. No. 3, pp. 135-136.

sulted in the separation of the species by means of the following key:

a. Scales of back very much to only slightly enlarged.

b. Scales between occiput and dorsal fin 15 to 17 along the median line; 8 above the lateral line; 75 scales in the lateral line; head broad and flat above. Gila Basin of Arizona.. ..... *clarki*[6] (Baird and Girard)

bb. Scales between occiput and dorsal fin 27 to 29 along the median line; 11 above the lateral line; 75 to 85 scales in the lateral series; ventrals reach the anus; head 4 into length, flat above; White River, Nevada. During Pleistocene epoch this river drained into Colorado River; now a closed isolated basin..... *intermedius*, n. sp.

bbb. Scales between occiput and dorsal fin 29 to 33 along the median line; 14 to 15 above lateral line; 76 to 80 lateral line; ventrals do not reach the anus; Santa Ana River, Southern California ..... *santa-anae* Snyder

aa. Scales of back not noticeably, if at all, enlarged.

c. Scales between occiput and dorsal fin 34 to 40 along median line; 14 to 17 above lateral line; 90 to 100 lateral line; Colorado River drainage from Virgin River north to Green River in Utah..... *utahensis* Tanner

cc. Scales between occiput and dorsal fin 40 ot 50 along median line; 15 to 17 above the lateral line; 80 to 92 in the lateral line series.

d. Head short and small, 4.9 to 5.1 in length; body slender; total length 3 to 6 inches. Rio Grande basin in Colorado..... *generosus*[7] (Girard)

dd. Head fairly large, 4.5 in length; body robust; 10 to 12 inches in length; Rio Grande basin of Colorado to Chihuahua..... *plebeius* (Baird and Girard)

Notolepidomyzon intermedius Tanner n. sp.

Description of the Type No. 4252: Head 4.0 times in length to base of caudal; depth 5.1; depth of caudal peduncle 11; dorsal rays 11; anal rays 7; scales before the dorsal 29; scales above lateral line 11; scales below the dorsal line 12; scales on the lateral line 85; snout to dorsal in proportion to total length 2; scales on the caudal peduncle 11 to 12.

The head is long and slender, depth about 2/3 the length, interorbital width 2.1 of length; top of head flat; fontanelle completely closed; width of mouth contained four times in length of head; width of mouth including lip 10 mm; papillae in 4 rows on upper lip and 8 to 9 rows on lower lip, the outer and inner rows smaller; cleft on lower lip moderate; 9 rows of papillae cleft to inner cutting edge of mouth.

---

(6) *Arizonae* Gilbert is considered as a synonym of *clarki*.

(7) The writer concures in Professor Snyder's suggestion, Proc. U. S. Nat. Mus. Vol. 59, 1922, p. 23, that *generosus* and *plebeius* may be one and the same species. A large series of these forms is needed in making a study.

MEASUREMENTS OF THE TYPE AND TWELVE PARATYPES OF NOTOLEPIDOMYZON INTERMEDIUS IN MILLIMETERS

All specimens were taken in small tributaries of the White River at Preston and Lund, White Pine County, Nevada.

Number	4252	5002	4255	4253	5003	4900	4902	4898	4901	4256	4257	4899	5007
Length of body	104.0	95.5	88.0	91.0	97.5	101.0	102.0	98.0	97.0	94.2	99.0	94.5	85.5
Length of head	25.5	23.6	20.5	22.5	24.2	25.5	24.5	25.3	23.0	23.0	23.9	23.0	20.5
Depth of body	20.0	18.0	16.0	19.0	19.1	21.4	19.5	19.1	19.0	18.0	20.0	18.3	17.0
Depth of caudal peduncle	9.5	8.3	8.0	8.7	8.6	9.0	9.0	9.0	9.0	8.3	9.0	8.0	7.5
Diameter of eye	3.9	3.9	3.9	3.7	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.9
Interorbital width	11.8	9.5	9.0	9.8	10.3	11.6	10.4	11.0	9.5	9.5	10.0	9.5	9.0
Depth of head	17.2	16.0	13.5	15.5	16.5	17.0	17.6	16.7	16.0	15.5	16.5	15.5	14.0
Snout to occiput	21.5	21.0	17.5	20.0	22.0	22.7	22.3	22.0	20.0	20.0	20.0	20.0	18.0
Snout to dorsal	53.5	49.0	43.6	46.2	51.0	53.5	51.5	50.0	49.0	46.5	49.0	47.1	43.0
Snout to ventral	62.0	56.0	48.5	51.6	59.8	61.5	60.5	59.1	57.0	54.8	59.0	55.0	55.5
Length base of dorsal	14.5	13.4	12.6	13.0	13.9	14.5	15.5	15.0	13.4	14.0	14.1	13.0	12.7
Length base of anal	6.5	6.5	6.4	6.1	6.8	7.5	8.0	7.5	6.5	7.0	6.5	7.0	6.2
Height of dorsal	19.0	19.0	17.0	19.0	21.5	20.0	20.0	21.1	19.8	19.0	20.0	18.6	18.0
Length of anal	19.0	19.0	17.5	19.0	20.0	22.0	23.0	21.0	19.7	20.0	20.5	19.7	17.0
Length of ventral	17.0	16.5	14.5	15.3	17.0	19.0	17.0	16.3	16.3	16.5	17.0	16.0	14.0
Length of caudal	18.3	18.5	17.5	19.0	22.0	23.0	22.5	23.2	21.0	21.0	23.1	20.9	17.9
Length of pectoral	22.0	21.0	18.3	20.0	22.0	23.0	22.2	23.0	21.8	21.0	21.5	21.0	18.5
Dorsal rays	11	11	11	11	11	11	11	11	11	11	11	11	11
Anal rays	7	7	7	7	7	7	7	7	7	7	7	7	7
Scales lateral series	85	77	78	83	83	83	83	77	77	84	77	83	79
Scales above lateral line	11	11	11	11	11	11	11	11	11	11	11	11	11
Scales below lateral line	12	12	12	12	12	12	12	12	12	12	12	12	12
Scales before dorsal	29	29	28	28	29	27	27	27	29	27	27	29	27

The dorsal is about 1/4 greater in height than length of base; anal 1.3 in head; the anal just reaches base of caudal; the ventrals just reach the anus; 5 scales above the lateral line on the caudal peduncle; lateral line straight except for a short upward curve at its origin where it passes above the operculum.

In life this species is greyish to olive green above becoming light yellow to whitish on the venter. In alcohol the specimens are dark to blackish above; mottled above, along and irregularly below the lateral line and whitish on the belly region; with a dark circular area on the operculum.

Comparison: *Notolepidomyzon intermedius* is closely related to cotype specimens of *N. santa-anae* which are before me. In *santa-anae* the ventrals do not reach the anus while in *intermedius* they do. *Intermedius* is also a much coarser scaled species than *utahensis,* as well as a smaller fish, being only 4 to 5 inches in maximum length.

Type Locality: White River, streams and springs, at Lund and Preston, White River Valley, White Pine County, Nevada. The type, no. 4252, paratypes Nos. 4253 to 4258; 4898 to 4902 and 5002 to 5011 and 5 small untagged specimens were collected by Mr. Guy L. Hendrix in July, 1942. The type and paratypes, except two each that are being deposited in the U. S. National Museum, Washington, D. C., Natural History Museum, Stanford University and Muesum of Zoology, University of Michigan, are in the Vertebrate Collection of the Brigham Young University.

Associated Species: The following species were collected with *N. intermedius*: *Crenichthys baileyi* (Gilbert); *Rhinichthys* (*apocope*) *velifer* Gilbert, or a new subspecies of it; and *Rhinichthys* (*apocope*) *nevadensis* Gilbert.

The White River Drainage: During the Pleistocene epoch this area, as well as the entire Great Basin, according to erosional features, was alternately dry and humid. Aside from large lakes of the basin, such as Bonneville and Labontan, there were many small ones. These small ones were connected by streams during the humid years and isolated or dry during the arid times. Fossil remains of a drainage system which connected White River with the Muddy and Colorado rivers is clearly preserved throughout its course. According to Mr. Everett Carpenter[8] there are two well defined

> "drainage systems in southeastern Nevada, those of Virgin River and of Las Vegas Wash, are tributary to Colorado River. Virgin River rises in southern Utah,

(8) Carpenter, Everett, 1915. Water-supply paper 365, Department of Interior, United States Geological Survey, p. 9.

flows southeastward across the northwest corner of Arizona, enters Nevada at Mesquite, flows past Bunkerville and St. Thomas, and discharges into Colorado River. The main tributary to this stream is Muddy River, which at present rises in the Moapa Indian Reservation but which in former geologic times had its source many miles to the north in the head of the White River valley. A well-deevloped and open channel extends from near the town of Preston southward through Pahranagat valley and into the Muddy River valley."

Acknowledgments: The writer is indebted to Mr. Grant B. Harris, principal of the Lund High school and a former major student of mine, for his encouraging Mr. Guy L. Hendrix, one of his students, to collect and preserve for us the fishes of this report. I also appreciate the loan of specimens, which were used in this study, from Dr. George S. Myers of Stanford University.

OBSERVATIONS ON THE ECOLOGY AND NATURAL HISTORY OF ANURA IX. NOTES ON BREEDING BEHAVIOR IN OKLAHOMA[1]

ARTHUR N. BRAGG and CHARLES CLINTON SMITH

It is well known that some single species of frogs or toads may breed at different times of year and use somewhat different types of breeding sites in different portons of their geographical ranges. This seems to be especially true of those forms whose distribution is of wide extent, particularly if the range traverse several degrees of latitude (Wright and Wright, 1933). It is less commonly understood that the details of breeding or other habits may vary, usually slightly but sometimes markedly, in different ecological situations; and that such changes of habits are often of great importance in the adjustment of a given species to the differences in various habitats within its geographical range (Bragg, 1940d; see also Blair, 1941). Because of these facts, it is not safe to generalize concerning the breeding habits of any species of Anura from its study in one locality only. Instead, one must study these habits in each ecological community wherein the species is found to determine (1) whether any variations in breeding pattern occur, and (2) if so, what factors (ecological or physiological) are involved in the changes. Only in this way can we approach complete understanding of the adjustment of a species to its environment and of the reasons for its geographical distribution and possible ecological segregation.

The breeding habits of Anura in Oklahoma are still imperfectly known. Those of some species of Bufo have been analyzed and notes on some others have been given in the earlier papers in this series (Bragg, 1940, 1940a, b, c, d, 1941; Bragg and Smith, 1942). The habits of *Scaphiopus bombifrons* Cope were given consideration by Trowbridge and Trowbridge (1937). Except for these papers, only incidental notes have been found in the literature dealing specifically with the Oklahoma forms as observed within this state. Since we have made observations upon breeding habits, breeding dates, and breeding sites in connection with our extensive field trips in Oklahoma during the past four years, it seems desirable that our findings be presented.

(1) Contribution from the Zoological Laboratory of the University of Oklahome, No. 229. Aided by a grant from the faculty research fund of the university.

Our general method of procedure has been to follow the weather reports as given by the local press or radio and to take trips at night during spring, summer, and autumn from Norman to other parts of the state wherever and whenever heavy or violent rains were reported. Since most species are influenced in their breeding behavior by the coming of rain, this method has enabled us to locate hundreds of breeding congresses and to observe the breeding reactions in as much detail as individual circumstances made to seem desirable. Our observations have naturally been more intensive, as well as more extensive, within a fifty-mile radius of our starting point at Norman in central Oklahoma. They have been least extensive in the panhandle. We have, however, visited at least once every one of the seventy-seven counties in the state.

Twenty-five species or subspecies of Anura are recognized as occurring in some part of Oklahoma. Of these, seven of the rarer forms have not been observed by us in breeding congresses. Three others have been found only a few times. The remaining fifteen have been seen often enough to justify our belief that we understand, at least in broad outline and often in some detail, the breeding pattern exemplified by each in Oklahoma. This is especially true as to the characteristic breeding sites used and as to the extent of the breeding season.

The observations are presented in three divisions: (1) the earliest and latest breeding date observed, together with other pertinent data, are presented for each species in Table 1; (2) annotated lists of breeding sites are given; and (3) miscellaneous unpublished observations on the breeding behavior of several species, thought for one reason or another to be of special interest, are presented. Identificacations of all forms are by us. Specimens have been deposited in the University of Oklahoma Museum of Zoology.

In the preparation of Table 1, care has been taken to report only those congresses of Anura which we have reason to believe were of such nature that eggs were eventually produced. Slight rains often stimulate a few males of some species to start calling without this resulting in actual breeding. Often, calling hylas and sometimes even calling ranas and bufos do not indicate breeding. The finding of tadpoles in pools we have taken, of course, as proof that breeding has occurred but these have been used as indicative of a breeding date only in exceptional circumstances: for example, if tadpoles of *Scaphiopus bombifrons* or *Bufo cognatus* are found two weeks after the only rain has occurred in the region, one seems justified in fixing the

date of egg production as on the night following the rain or within two or three days thereafter.[2] This is because these species breed only after rain. A similar situation involving any species of Rana, *Bufo w. woodhousii,* or *B. a. americanus* in Oklahoma does not necessarily indicate this. In all such cases, we have used our best judgment based upon our total experience. It should also be noted that in construction of Table 1, the number of congresses reported is not the actual number visited in the course of this study. On some of our trips we have found areas as large as whole counties which sounded like one huge chorus of amphibian voices. We may have visited as many as fifteen or more separate congresses in such an area on a single night. Ordinarily we have considered such cases as one experience for each species represented at each type of breeding site within the area and have so recorded them in Table 1.

Weather data given in this paper are from three sources: (1) from summaries obtained from the U. S. Weather Bureau at Oklahoma City, (2) from the local station at the University of Oklahoma, and (3) from our own observations of air and water temperatures taken in the field in a few instances.

BREEDING SITES

Breeding sites for Anura in Oklahoma are quite varied in character. In the wooded and hilly regions of eastern Oklahoma, streams are often clear and, in some reaches, fairly swift. Some, however, like the Kiamichi, are in some parts sluggish, deep, and muddy. In the region of the mixed-grass prairie (central Oklahoma) most streams are trancient, their floodplains being either broad sandy wastes or deep dry ravines for long periods between floods. Small streams entering such rivers as the Canadian or Cimarron in central Oklahoma, especially from the east or north, are often blocked by sand dunes and form sloughs along the edges of the flood-plain. Such sloughs vary much in character with the season, with the amount of rainfall, and with local conditions. They may be muddy or clear and, during the hot weather of summer usually run through the cycle typical of stagnant water anywhere, eventually disappearing altogether if not replenished by rains. Several species of frogs and toads utilize these sloughs for breeding, especially in early spring.

Muddy cattle tanks are present in large numbers in almost all

(2) *B. cognatus* may call for from one to five nights under the stimulation of a single rain; *S. bombifrons* may call from one to three nights. Eggs of the former are most often laid on the second night, those of the latter, on the first.

regions of Oklahoma. Buffalo-wallows occur in all of the mixed-grass and most of the short-grass prairies, i. e., from the central portion of the state westward. They do not occur in the more sandy soils of the eastern part of the state nor in the sand prairies of the short-grass association in the west. They cannot occupy these regions because the sandy soil fails to become puddled to such extent as to hold the water. Buffalo wallows may have either clear or muddy water, depending upon local conditions. In the mixed-grass prairie, they are more commonly clear, unless located in severely overgrazed pastures.

Flooded fields and ditches are of several different kinds. In some regions, such areas may be very extensive and, although temporary, quite deep after heavy rains. We have waded waist-deep in temporary water on several occasions. On the other hand, some extensively flooded fields are shallow, not more than one foot at the deepest part, and often with an acre or more of water only a few inches in depth. Either type may be muddy or clear depending upon local conditions; but shallow, temporary water, whether in fields or ditches, is more often clear than muddy. In contrast, deep temporary water in Oklahoma is usually muddy.

As will be seen from the following lists, some species use only certain types of these sites for their breeding activities; others use several. This ecological segregation is best noted when radically different conditions are found in two pools situated close together. On several occasions in central and western Oklahoma we have found *Bufo cognatus* separated in this way from *B. woodhousii woodhousii* (see also Bragg, 1940 and 1940a). In one case we found them segregated in two parts of the same pool. The local situation was a peculiar one. A fence separating two fields crossed a depression in which the pool was formed. One field had been plowed; the other had not. During a violent shower, muddy water from the plowed field rushed into the depression from one side while clear water drained from the grass-covered unplowed field opposite. The result was a pool in which the water graded from quite clear at one end to excessively muddy at the other. The whole pool was shallow and only slightly deeper on the muddy side. There was a large chorus of *B. cognatus* at and near the clear end of the pool and a smaller number of *B. w. woodhousii* (probably about twenty) calling in the muddy section. We found no evidence of the mixing of the two species.

Some species are kept apart within a single breeding site by the reactions of individuals of both sexes to the calls of their own species

(see Bragg, 1940a for a case of this kind among several species of Bufo). Other closely related species do not intermingle much due to different reactions of the males. This is well seen in Scaphiopus. *S. couchii* often breeds in the same pools with *S. bombifrons* in southern and southwestern Oklahoma. Males of the former call from the bank or from very shallow water at the pool's edge. Females gather about a male in a sort of semicircle. Eventually, the male jumps and catches a female and they enter the water together (Ortenburger, 1924). Males of *S. bombifrons* seldom call from the bank (we have observed this on two occasions). Usually they call sprawled out on the water and attract their females to them here (Trowbridge and Trowbridge, 1937). In this way these two species are segregated until females have been mated. There is some indication that other species of Scaphiopus may be segregated in the same manner. This is suggested by our limited observations on *S. hurterii* and also by those of Smith and Leonard (1934) who found this form breeding with *S. bombifrons* in central Oklahoma. It is not quite clear how this segregation works when *S. bombifrons* occupies the same pool as *S. hammondii* but some recent observations in New Mexico suggest strongly that there is such a mechanism (Bragg, 1941a). We have not seen these species together in Oklahoma.

Some closely related species are known to be interfertile and others are strongly suspected of being so. Such differences in habits as described above will go far toward explaining why interbreeding is so infrequent in nature even though two interfertile species may use the same water at the same time. (See also Blair, 1940, 1941). When such factors are not operative for any reason, as when a species changes its habits at the border of a range, interbreeding may occur more frequently. The detailed study of habits, therefore, may be of great value to those interested in intergradation of subspecies where ranges meet.

OUTLINE OF BREEDING SITES AND THE SPECIES USING THEM IN OKLAHOMA

1. *Permanent deep water* (rivers, artificial lakes, deep ponds). *Acris crepitans* and *Rana sphenocephala* on or near the edge in shallow water, usually among aquatic vegetation. *Rana catesbeiana* calling on or near the bank, eggs floating in deeper water. *Bufo w. woodhousii* commonly breeds in muddy backwashes of large rivers and creeks and occasionally in artificial lakes of whatever size. *B. w. fowleri* was found calling in numbers on the muddy bank of the slow-flowing and

deep Kiamichi river one night. Tadpoles of the same species have been found in clear deep water of the Mountain Fork River in McCurtain County.

2. *Small, clear-water streams* (eastern and southern Oklahoma). *Bufo americanus americanus* and rarely *B. w. woodhousii* in shallow flowing water; these species and *Acris crepitans, Hyla versicolor versicolor, Pseudacris triseriata,* and *Rana sphenocephala* in shallow backwashes and overflow areas. *B. w. fowleri* also used clear, sandy-bottomed streams.

3. *Sloughs and backwashes on the floodplains of muddy creeks and rivers* (certainly of the Arkansas, Cimarron, Canadian, and N. Canadian and probably of the Red) *Bufo a. americanus* occasionally (two observations), *B. w. woodhousii* very abundantly, *Rana sphenocephala* very abundantly, *Pseudacris triseriata* rarely and in small numbers.

4. *Sloughs of relatively clear water on the floodplains of large rivers. Acris crepitans* and *B. w. woodhousii* very abundantly; *Pseudacris streckeri* characteristically; *Rana sphenocephala* very commonly; *Ps. triseriata* (one observation).

5. *Flooded shallow fields and shallow ditches of clear water, usually with considerable vegetation protruding through them. Bufo cognatus, B. compactilis, Microhyla olivacea, Pseudacris clarkii, Ps. triseriata, Scaphiopus couchii,* all in large numbers; *B. w. woodhousii, Ps. streckeri, Rana sphenocephala,* and *Scaphiopus bombifrons* in small numbers. *Bufo insidior* has been taken in this situation in small numbers also but the small numbers are thought to be due to the comparative rarity of this species.

6. *Buffalo wallows of clear water or similar small shallow clear-water pools. Bufo cognatus, B. compactilis, Microhyla olivacea, Ps. clarkii,* and *Ps. triseriata,* often in large numbers; *Scaphiopus bombifrons* in small numbers.

7. *Deep, muddy pools of all sorts* (ditches, flooded fields, cattle tanks, etc.). *Bufo americanus, B. woodhousii fowleri, B. w. woodhousii, B. compactilis, B. insidior,* (in shallow water near edge); *Hyla versicolor versicolor, Rana areolata areolata, Rana sphenocephala, Scaphiopus couchii, S. hurterii,* and *S. bombifrons* (characteristic breeding site). *Rana catesbeiana* is often present in large numbers in some such pools and has been heard calling in them once or twice. They breed here sometimes, for their tadpoles have been found in cattle-tanks.

8. *Rock-bottom pools of small extent. Bufo punctatus* embryos,

just hatching, were found once in the Wichita Mountains (Bragg and Smith, 1942).

9. *Pools in creeks. Acris crepitans* and *Rana sphenocephala* occasionally.

The condition as to roiliness and depth of water may be summarized thus:

1. *Species characteristically breeding only in clear, shallow, temporary pools. Bufo cognatus,* and *Ps. triseriata.*

2. *Species to which roiliness of the water seems to make little difference. Acris crepitans, Bufo a. americanus, B. compactilis, B. w. woodhousii, Hyla v. versicolor, Microhyla olivacea, Pseudacris streckeri, Ps. clarkii, Rana spenocephala, Scaphiopus bombifrons, S. couchii, S. hurterii.*

3. *Species usually using water not more than 10 inches (usually less) in depth. Acris crepitans,* all species of Bufo, *Hyla v. versicolor, Microhyla olivacea,* all species of Pseudacris with the exception of *Ps. streckeri,* probably *Rana a. areolata* (too few observations for certainty).

4. *Species usually requiring deep water (one foot or more). Rana catesbeiana, R. sphenocephala* (some exceptions), *Scaphiopus bombifrons, S. couchii,* and *S. hurterii. S. bombifrons* sometimes breeds in shallow water in small numbers (buffalo wallows). In New Mexico it sometimes uses very shallow pools (Bragg, 1941a), and we have on two occasions found males in shallow water in Oklahoma.

MISCELLANEOUS OBSERVATIONS

A. *The Breeding Season*

The question of a breeding season among several species is of some interest. Most species of frogs and toads are thought to have a quite definite breeding season, in the southern states often more extensive than in the northern. Except for the fact that most Oklahome species breed only in the warmer months (March to September), we find that several forms have no such season; and those which do not have one are typically those species especially adapted to life in the prairie (Bragg, 1940d, 1941: Bragg and Smith, 1942). Other species have a definite breeding season here, as well as elsewhere. Three species are of special interest in this respect, *Pseudacris streckeri* Wright and Wright, *Microhyla olivacea* (Hallowell), and *Scaphiopus bombifrons* Cope.

Ps. streckeri breeds (or at least calls vigorously) in midwinter in

Oklahoma. The earliest record is that of January 1 (1941) following heavy rains. On this date thousands of males were calling in Pontotoc, Coal, and western Hughes counties during a day somewhat warmer than usual for this season.[3] At Norman, they have been heard in numbers in the sloughs of the Canadian river many times between February 1 and mid-May. Rain after May 23 does not seem to stimulate further breeding activities. The earliest that we have known a female to produce eggs was on the night of February 26, but these eggs did not develop. It would seem, therefore, that *Ps. streckeri*, like its close southern relative, *Ps. ornata* (Holbrook) tends to have an exceptionally early breeding season. We have records of males calling at an air temperature of 0 degrees C. and in water near 0° C. (For details of breeding habits, see Bragg, 1942.)

Microhyla olivacea is in marked contrast to the above. We have heard this species only incidentally before April 30 and usually not in numbers before May 8. From this time on through the summer into September, it breeds only after rains; and any rain of appreciable amount will bring them to pools and ditches in numbers. We have often found clasped pairs and eggs in pools containing well-developed tadpoles, and in several other instances, have observed metamorphosing young leaving a pool in which males were calling vigorously and females were present. This is a species, therefore, which starts its breeding rather late in the spring, at least in Oklahoma, thereafter following the rains throughout the summer. It seems probable that earlier breeding is inhibited by low temperatures.

Scaphiopus bombifrons is especially interesting, since our observations indicate interpretations somewhat different from those of some other workers. It is often stated or implied that the plains spadefoot typically emerges to breed only once in a season in any one locality. We find this not to be true, either in New Mexico (Bragg, 1941a) or in central Oklahoma. Three large congresses developed at Norman, Oklahoma in the spring and early summer of 1940, coming on May 21-22, June 12-13, and July 2-3, in each case during or immediately after very violent or heavy rains. There were also several large congresses here in the spring of 1941.

Trowbridge and Trowbridge (1937) studied this species over a period of three years at Norman. Among other things, they point out that for the period from 1934 to 1936 inclusive, this spadefoot did

(3) We are indebted to Mr. O'Rielly Sandoz, while acting as ecological field worker for the Oklahoma Fish and Game Commission, for these observations.

not breed after the first spring rain but did breed later in the spring of each year after rains, sometimes of less extent than those which had come earlier. They found also that the spadefoots did not breed until at least a total of 3.66 inches of precipitation had accumulated. From this evidence they thought it probable that *S. bombifrons* has a definite breeding season, modified by the coming of rain and that a certain amount of precipitation must accumulate before breeding activity commences. It was clearly stated that this conclusion was only tentative and an appeal was made for other workers, who had opportunity, to check it.

This we have attempted to do from observations made principally in the area studied by the Trowbridges at Norman and often from experiences at the same pools visted by them. It is deemed best to present the evidence in some detail in order that our observations may be compared with theirs. The observations cover the five-year period from 1937 to 1941 inclusive. During 1937 one of us (Bragg) was in the field with A. H. Trowbridge and in 1938 and 1939 with M. S. Trowbridge to whom we are indebted for certain observations and notes. All remaining observations were made by us and the interpretations of all of the observations were made without consultations with the Trowbridges. We are, therefore, wholly responsible for the conclusions drawn.

In 1937, Febraury was very dry at Norman, only 0.31 inches of precipitation being recorded. In March, the total was 2.17 inches, the largest amount (0.55 in.) falling on the 13th. April had a total of 1.83 in., most of it coming in a single storm on the 20th. (1.25 in.). The total precipitation from February 1 to April 20 inclusive was 4.11 inches, i. e., 0.34 in. above the minimum found effective as a breeding stimulus by the Trowbridges. The spadefoots did not breed at this time, despite the fact that the minimum temperature on the day of the storm was not below that critical for emergence (see beyond). The rainfall in May totaled 2.13 inches. The spadefoots did not breed after rains of 0.57 in. on the 11th, or 0.96 in. on the 30th, amounts which at other times have brought them out in this and other areas. Temperatures were much too high to have had an inhibiting influence. June continued rather dry and the weather became hot. Light showers of from 0.10 to 0.48 in. fell during five of the first ten days. On the 16th a sharp shower brought 0.66 in. of rain and that night A. H. Trowbridge and one of us found a small congress south of the university campus. Several clutches of eggs were produced here and, later, tadpoles were found in a buffalo wallow nearby which had been

dry before the storm. There had been a total of 8.54 inches of precipitation since February 1, most of it in the form of light showers or slow rains.

In 1938, a total of 7.35 inches of precipitation fell in February, all storms of 0.90 inch or more at temperatures low enough to inhibit breeding, even if it could otherwise have occurred. March was dry till the 26th, a total of only 0.35 in. in two showers being recorded. On the 26th a storm totaling 2.02 in. came. That night, the temperature was 9° C. and no breeding occurred. The following day had intermittent showers totaling 0.90 in. That evening spadefoots were calling in numbers all about Norman at a temperature at just less than 12° C. The following day was rainy (total 2.19 in.). There had been a total precipitation of 5.11 inches in three days. That night, the whole country-side was reverberating with anuran calls, the spadefoots in great numbers among them. The temperature at 9:15 was just less than 12° C. and at 1:00 A. M. it had risen to 14° C. Numerous clutches of eggs were produced in at least a dozen breeding sites about Norman. There was no further breeding activity either in April or after rains in May which brought out *B. cognatus*. Observations were not made in June or July.

In 1939, precipitation in March totaled 1.86, most of it in one rain (1.03 in.) on the 28th and 29th. Temperatures were too low (3° C. at one time) for breeding. April was dry (total 0.51 in.) but May had 4.18 in., the largest storm being 1.27 in. on the 13th. The species did not breed. June had numerous light showers with a rain of 1.6 in. on the 12th. and another of 0.95 in. on the 25th. The first congress of spadefoots occurred on June 28th during and after a rain totaling 3.78 in. The total for June prior to this time was 3.84 in.

The season of 1940, in some respects, showed more than those of the previous three years. Total precipitation for the spring months was as follows: February, 3.18 in.; March, none; April, 4.25; May (to the 21st), 3.39. Significant storms occurred as follows: Apr. 5-6, 1.33 in.; Apr. 11, 1.30 in.; Apr. 28, 1.20 in.; May 16, 0.65 in.; and May 21-22, 1.80 in. The spadefoots first emerged to breed on the night of May 21 after a particularly violent storm late in the afternoon. As mentioned earlier, there were also two other heavy congresses at Norman late in the spring and early in the summer.

These observations may be summarized as follows: (1) *Scaphiopus bombifrons* bred only after rain in each of the four years. (2) The least rain after which they bred was 0.66 in. (June, 1937). (3) The least accumulated rain before their breeding was 6.44 (1937). (4)

They sometimes did not breed after more than an inch of rain when the accumulated precipitation was more than the minimum observed by the Trowbridges. (5) They usually did not breed after the first spring rains and often failed to do so after rains greater in amount than other rains after which they had been observed to breed at other times. (6) *S. bombifrons* failed to breed below a temperature of 9° C., but did breed abundantly at just below 12° C. when other conditions seemed favorable (observations of 1938). We may set the temperature below which they do not ordinarily breed as close to 11° C.

From the above facts, it is evident that at least one factor not shown in the observations of the Trowbridges must be operative as a stimulus for the initiation of breeding behavior. Further analysis of the data indicates that this is the violence of individual storms. One-half inch of rain falling within one-half hour is often as great a stimulus as more than twice this amount spread out through a period of several hours. Both the absolute amount of rain and its rate of fall are factors in the situation, the largest congresses developing during and after heavy rains in which sharp showers fall, i. e., when both factors are operating together. Below are presented some observations which tend to illustrate these things.

The rain of April 20, 1937, totaling 1.25 in., was slow and progressed through several hours. Notes, written on that date, say, "It rained intermittently nearly all day. *B. cognatus* were calling in numbers tonight but only a single *S. bombifrons* was heard." Contrast this with the notes taken on June 17, 1937. "Estimated about one-half inch of rain in the hour before nine A. M. Later, hot most of the day, out in the evening in bright moonlight south of the campus. Congress of Scaphiopus in cornfield, attaching eggs to leaves of Polygonon sp.—water temperature at the surface, 38° C., six to eight inches below, 29° C." Another illustration came on May 12, 1939. A rain totaling 1.27 inches fell slowly during most of the night. No spadefoots were found out the night of the 13th; but on June 28 they bred abundantly after what the notes say was a "heavy rain in several showers" (total, 3.78 inches). A third experience is of special interest because it illustrates to some extent the intensity of the stimulus of a very violent storm. This occurred near Clinton in western Oklahoma. On April 11, 1940, the Norman Transcript carried a story of a violent storm in this region. Among other things it said, "A hail storm slashed at Clinton and nearby Arapaho for thirty minutes last night—automobiles were swept into ditches as water gushed from a

2.44 inch downpour." The U. S. Weather Bureau corroborates the newspaper's statement as to the amount of precipitation but indicates that "The hail storm continued for about one hour." The storm was accompanied by a marked drop in temperature, the lowest reading of the month at Clinton (24° F.) being recorded on the 12th. This is much below the critical temperature for the emergence of *S. bombifrons* as found at Norman. On the night of the 13th, we visited this area. A medium sized congress of *S. bombifrons* was found in a deep cattletank about three miles northeast of Clinton in water uncomfortably cold to wade. Both males and gravid females were present. Hailstones were still piled along one side of the tank. No other Anura were found breeding between Arapaho to the north of Clinton and the northern city limits of Cordell, Washita County, to the south. Since the temperature was much too low immediately after the storm, it is probable that no spadefoots bred before the night of the 13th. That they did so on the 13th indicates that the exceptional violence of the storm constituted a stimulus so great that the breeding urge remained through two days of cold weather becoming expressed in a breeding congress as soon as the slowly rising temperature allowed.

The above experiences are only samples of several similar observations in various parts of Oklahoma. See also Bragg (1941a) for observations in New Mexico. Our total experience, therefore, indicates the following conclusions as regards the initiation of breeding behavior of *S. bombifrons*: (1) Breeding may occur at least between late March and early July in Oklahoma whenever the following conditions are met: (a) the temperature must not be lower than about 11° C., (b) it must have rained at least about 0.50 in., (c) a small amount of rain falling as a violent shower is a greater stimulus than a much larger amount coming slowly over a longer period of time. (2) There is no true breeding season in this species; breeding can occur at any time in spring or summer when the conditions outlined above obtain.[4] (3) The amount of accumulated moisture in the springtime as emphasized as a possible factor by the Trowbridges has

(4) August breeding in Oklahoma is still unobserved. However, it has been seen in the plains of Kansas (H. M. Smith, 1934), which is something like Oklahoma ecologically, as well as in New Mexico (Bragg, 1941a). It seems probable that the scarcity of records in summer in Oklahoma is due in part to the very hot dry weather characteristic of July and August in most years and in part to the fact that during most seasons storms of the violent type come in spring so that most spadefoots have a chance to complete their breeding before summer. It does not seem probable that they would repair to breeding pools after rain if their sex products have already been shed. The gonadal cycle undoubtedly has some influence.

either negligible or no effect upon the breeding of this species. (4) The fact that the spadefoots do not always breed after the first spring rains is due to the effect of low temperatures, to the lack of violence of the individual storms, or to the combined effect of these two factors.

B. *Time of Day During which Breeding Occurs*

The time of day during which anuran breeding occurs in Oklahoma varies somewhat with conditions and with species. As might be expected, most breeding congresses are built up at night; when they occur in the daytime, they usually foretell a much larger congress in the evening and through the night of the same day. Such species in central Oklahoma, where most detailed observations have been made, include *Bufo cognatus, Pseudacris clarkii* and *Microhyla olivacea.* More rarely *Bufo w. woodhousii* and *Scaphiopus bombifrons* behave in this manner also. Another group of species may start calling, often in large numbers, at any time of day or night. In central Oklahoma *Acris crepitans, Pseudacris triseriata,*[5] and *Ps. streckeri* are examples. Concerning the second of these, we have several times heard congresses in bright sunshine about Norman only to find the pool completely silent when we returned in the evening to secure specimens.

Daylight breeding congresses are true breeding aggregations. We have often found clasping pairs within them, especially of the bufos.

C. *Effect of Severe Cold on a Breeding Congress of Bufo w. woodhousii*

Below about 13° C., *B. w. woodhousii* rarely starts breeding activity; but if a large and active congress is in progress when the temperature falls suddenly to freezing or below, this continues to the probable production of eggs. Observations supporting these statements follow.

After a 1.33 in. rain on April 6 and 7, 1940, a very large mixed chorus of *B. w. woodhousii* and *Pseudacris streckeri* developed on the evening of the 10th. in the sloughs of the Canadian river near Norman. Many clasping pairs of the bufos were observed in water four to six inches deep at about 9:30 P. M. At about midnight, a heavy thundershower accompanied by a violent north wind brought cold weather

(5) This is the species of Pseudacris mentioned by Bragg (1940a) as unrecognized in Cleveland County.

(min. temp. 5° C.) and a continued wind (20 miles per hour near the ground) the next day. A visit to the breeding site early in the afternoon revealed that conditions were much as the day before, except that there was much more water in the sloughs. Males were still calling in small numbers, mated pairs were present (about twenty were counted) mostly lying on the bottom or along the edge where the latter were buffeted by waves. No eggs could be found and none of the pairs were producing them. Evidently conditions were such that females refused to lay their eggs even though many had been clasped for a long time by males. Some of the toads were slow and lethargic, particularly the mated pairs on the bottom. Others were still alert to danger and some of the unmated males plunged into the water when approached. The temperature continued to fall and the next morning was below freezing (26° F.) although it had warmed to 40° F. by noon. Another visit to the breeding site at 2:00 P. M. showed conditions to be almost exactly as the day before.

Because of making trips to other parts of the state, observations were discontinued here until the 25th, on which date thousands of tadpoles of *Bufo w. woodhousii* were present. They appeared to be about two weeks old, judging by their size. Since they could not have come from eggs laid before the 10th, and probably not before the 13th, we think it likely that they came from the mated pairs seen here during the cold wave. Assuming this to have been the case and interpreting on the basis of our hypothesis as to the function of the clasp of the male (Bragg, 1941), the cold inhibited the functioning of the pituitary until the weather warmed on the 13th and 14th. Then normal breeding was resumed.

D. *Position of the Males of Some Species While Calling.*

Rana areolata areolata often calls while sprawled out on the water something after the manner of the plains spadefoot. While thus engaged, it is not particularly disturbed by a flashlight and is relatively easy to collect. Some individuals of this species, as well as of *R. sphenocephala*, call from the bank. *Pseudacris clarkii*, like most other members of this genus in Oklahoma, usually utters its breeding call from under banks or from clumps of vegetation to which it is hanging with its hands. Sometimes, however, it calls in umbers from tall grasses some distance from the water. This usually occurs in late afternoon prior to a night very favorable for the breeding of this species and almost always after rains. This probably occurs as the

males are moving in towards the pools to form a breeding congress, for the whole appearance is as though the little fellows just cannot wait to find water before starting their calls. The habit may have a function such as the guilding of other members of the species to proper pools but of this we are not certain.

Scaphiopus hurterii has been seen by us in breeding congresses on a few nights only. Males in one congress called from temporary muddy pools bordering a flooded ditch in water about three feet deep. These were spread out on the water. Others in this congress called from shallow water near the bank. Some miles away, another congress had developed in a shallow muddy ditch. Some were sitting in the muddy water and others were calling from the bank, completely out of water. In 1941 they bred three times in one pool under observation but did not enter a slightly deeper pool near by. These observations suggest those of Smith and Leonard (1934) on a congress of this form in Cleveland County, Oklahoma. We are able to confirm also that the call of this form is distinctive. It is a single not unpleasing squawk given rather suddenly and explosively at intervals of about two seconds. It has some carrying power but is not nearly so loud as that of *S. bombifrons*. Judging from the work of Ball (1936), our observations on the call and calling position tend to confirm the anatomical evidence of H. M. Smith (1937) that *S. hurterii* is distinct, taxonomically, from *S. holbrookii holbrookii* (Harlan).

E. *The Call of Bufo w. woodhousii*

Attention was given earlier to the fact that *B. w. woodhousii* has two radically different types of call (Bragg, 1940a). We have since found that the typical breeding cry of this subspecies is surprisingly variable in character. It is sometimes a very short call; at other times much longer. Often it is hoarse; at other times, much higher. The various variations are next to impossible to describe but they are quite evident in almost any fairly large congress in any part of the state. One variation, given several times consistently by two different individuals in different breeding congresses, suggests the cry of a young human baby. The variations do not seem to be correlated with size of individuals, type of breeding site, or the numbers present.

SUMMARY

Intensive and extensive field observations over several years on the breeding of Anura in all parts of Oklahoma form the basis for an

analysis of breeding sites, breeding dates, and a series of miscellaneous notes on isolating mechanisms tending to show ecological segregation even of closely related forms. The principal conclusions are: (1) Some species in Oklahoma have a breeding season in the usual sense of this term—others do not. (2) In the latter, initiation of breeding behavior is brought about by the coming of rain. (3) The prairie-limited species invariably breed only after rain; those not so limited may be stimulated by rain but commonly breed without it. (4) Breeding sites differ for different species: Some prefer clear water, some muddy water, others show no selection on this basis; some use only shallows, others only deeper lakes, rivers or ponds; some use only temporary water, others only permanent water, and still others both. (5) Interspecific isolation in breeding within one pool is often effected partly or solely by differential behavior of males, of females, or both, particularly in regard to the attention paid to the call of the male and in the specific behavior pattern of the males in securing mates.

A considerable discussion of observations over a period of four consecutive years shows that the tentative conclusions of Trowbridge and Trowbridge (1937), namely that *Scaphiopus bombifrons* breeds only after a certain amount of precipitation has accumulated, is unfounded. Instead, this animal breeds at any time, at least from late March to early September, after *violent* (as opposed to *heavy*) rains provided the temperature is not below approximately 9° C. Most breeding occurs after heavy rains coming in several violent showers, but a violent rain of as little as 0.5 in. is a greater stimulus than one of 2.0 inches which falls slowly.

A table of inclusive breeding dates observed for nineteen of the twenty-five species known in Oklahoma is presented.

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TABLE 1

Dates between which breeding has been observed for several species in Oklahoma. A summary of breeding sites in included.

Organism	Times seen breeding				Dates (min.-max. records)		Breeding sites
	Call only	Pairs seen	Eggs or larvae	Total breeding record			
Acris crepitans	65	3	10	78	4/2	8/17	shallow pools, stream margins
Bufo a. americanus	42	17	15	74	4/3	6/28	streams, ditches, ponds, tanks
B. cognatus	126	50	40	216	3/3	8/9	shallow clear pools, ditches
B. compactilis	8	3	0	11	4/16	8/9	shallow pools, ditches
B. insidior	3	2	0	5	4/29	8/9	shallow pools
B. punctutus	0	0	1	1	5/7	5/7	very small rock pools
B. w. fowleri	15	0	3	18	6/10	6/16	river margins, small lakes
B. w. woodhousii	120	45	40	205	4/4	8/9	any standing shallow water
Hyla v. versicolor	30	15	10	55	4/15	8/24	tanks, flooded creeks, ditches
Microhyla olivacea	102	26	20	148	4/16	9/4	shallow temporary water
Pseudacris clarkii	105	9	7	121	3/31	9/4	grassy clear pools, ditches
Ps. triseriata	21	1	2	24	3/30	6/23	grassy clear pools, ditches
Ps. streckeri	65	3	10	78	1/1	5/23	clear sloughs, ditches, fields
Rana a. arcolata	3	0	0	3	4/13	4/13	ditches, fields
R. catesbeiana	6	0	17	23	4/16	6/7	lakes, large streams
R. sphenocephala	72	40	97	209	2/12	9/4	all standing water except buffalo wallows
Scaphiopus bombifrons	45	22	20	87	3/27	7/3	deep temporary pools
S. couchii	8	1	1	10	4/16	8/9	tanks, fields
S. hurterii	4	0	4	8	4/15	9/4	ditches, gravel pits, ponds
Total	840	237	295	1372			

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SOME UNUSUAL WINTER VISITORS OR LATE MIGRANTS TO THE BEAR RIVER MARSHES, UTAH [1]

CLARENCE COTTAM, CECIL S. WILLIAMS,
and
CLARENCE A. SOOTER

The marsh and water area near the mouth of the Bear River in northern Utah is one of the Nation's most important nesting and concentration points for marsh and water birds. No fewer than two million ducks concentrate here late in the summer and early in the fall, and probably as many marsh and shore birds find a favorable habitat during this period.

It is not surprising, therefore, that within such concentrations the bird student should occasionally find rare or accidental visitors or abnormal individuals that have failed to migrate or that have postponed migration until winter has begun. This refusal to migrate—or the unseasonably late migration of species that normally migrate in the fall—may be due to physical handicap or physiological abnormality; it may also be associated with unusual weather conditions. Most of October and much of November 1941 were not unusual, although periods of freezing temperatures occurred after Thanksgiving. December was surprisingly warm during the first 2 weeks, the weather becoming severe on the 19th. Much of the marsh and water area in northern Utah was frozen over periodically after mid-November, and it is strange that delayed migrants did not leave at that time.

An account of the more uncommon birds found near Great Salt Lake, mostly during the latter part of December, 1941, follows:

Aechmophorus occidentalis. Western Grebe. Three individuals were seen in the main canal near Bear River Migratory Bird Refuge headquarters on December 14, 1941, by Superintendent Vanez T. Wilson and members of the staff. Larger numbers had been seen on the Refuge before this date. On December 28 —during a period of heavy snow, strong wind, and freezing temperature— Williams and Sooter observed two Western Grebes in a spillbox runway of Unit 5. Two more of the species were seen on the Refuge on December 27, and two were noted near Ogden on January 10, 1942.

Podilymbus p. podiceps. Pied-billed Grebe. This species commonly winters in small numbers at the Refuge; during the winter it may be found on open water throughout Salt Lake and Utah Valleys. No fewer than 50 individuals were seen on the Refuge on December 16, 1941, and 1 was seen on December 28

(1) Contribution from the United States Fish and Wildlife Service.

during a blizzard. Sooter and Williams observed 18 birds on January 5, 1942, in an unfrozen pot-hole of the Bear River.

Pelecanus erythrorhynchos. White Pelican. One bird flew into a telephone wire on November 15, 1941, and broke its wing. This bird was rescued later and placed in the "hospital" pond near Refuge headquarters. The bird seems to have recovered and is enduring the weather very well.

Ardea herodias treganzai. Great Blue Heron. Probably a limited number of Treganza's Herons winter each year on the Bear River Refuge. On December 16, 1941, the writers were much surprised, however, to find about 75 (a number far greater than that recorded for a December date in any preceding year) on the Refuge. Sixteen birds were recorded on December 27, two on December 28, 1941, and one on January 5, 1942.

Egretta thula brewsteri. Brewster's Egret. A few Snowy Egrets, presumably of this race, were found on the Refuge until the end of the first week of December 1941. They are common summer nesters in this section of the State.

Nycticorax nycticorax hoactli. Black-crowned Heron. A limited number of Black-crowned Night Herons normally winter on the Bear River Refuge. Young were noted in nests during a snowstorm on March 8, 1940, indicating that nesting began in February. Nests may be found early each spring. Eight birds were observed by the Refuge staff during the Christmas bird census, December 27, 1941.

Plegadis guarauna. White-faced Glossy Ibis. These are common summer visitors to the Refuge but usually migrate late in September or early in October. During the fall of 1941, fair numbers remained in October; 12 were seen near Refuge headquarters on December 7; and 4 birds remained on Unit 1 until December 26. They were an annoyance to some duck hunters; the birds circled excitedly over the hunters' blinds, giving their discordant alarm calls that tended to spoil the duck shooting.

Cygnus columbianus. Whistling Swan. The Bear River marsh area is the favored fall and winter home of thousands of Whistling Swans. Supt. Wilson estimated that there were about twelve thousand on the Refuge during the Christmas bird census on December 27, 1941.

Querquedula cyanoptera. Cinnamon Teal. Although Cinnamon Teals are common nesters in favorable habitat in northern Utah, the birds usually migrate early, very few remaining by the first of October. It may be of interest to report that on the last day of the open season (December 14, 1941) one Cinnamon Teal was shot on the shooting grounds of Bear River Marshes, and that during the 8-week open season (October 16 through December 14) 121 passed through the checking station. Cottam has seen this bird on Utah Lake about the middle of February (1926).

Glaucionetta islandica. Barrow's Golden-eye. A pair of Barrow's Golden-eyes were seen on Unit 2, in company with five American Golden-eyes. The former are listed here merely because they are infrequently recorded in Utah, although they are probably more common as winter visitors to the State than our records indicate. Dr. E. R. Quortrup reports seeing several birds on the Bear River Refuge during the 1939-40 and 1940-41 winters, and he adds that he has a male skin taken on the Refuge during the 1939 hunting season.

Clangula hyemalis. Old-squaw. This bird is of rare and erratic occurrence in Utah, although 13 specimens were taken on the Bear River Refuge during the 1934 hunting season. Occasionally, others have been seen just before the winter freeze. On December 10, 1941, Dr. Quortrup and Supt. Wilson observed an adult male on Unit 5.

Melanitta deglandi. White-winged Scoter. Because of the paucity of scoter records in Utah, it may be of interest to report that one bird was seen on Unit 5 of the Refuge on October 1, 1941, and two birds were taken on the shooting grounds during the open season.

Haliaeetus leucocephalus. Bald Eagle. The American emblem is an uncommon visitor to Utah during the summer but a conspicuous visitor to the Bear River Marshes during the coldest part of the winter. This fact strongly suggests that the Utah winter bird is of the northern race *H. l. alascanus*, although critical study of the specimens has not yet been made. On December 16, 1941, one Bald and one Golden Eagle were seen on the Refuge; three were seen on December

27; and two Bald Eagles were observed along the Bear River on January 5, 1942. During January and February, 6 to 10 birds may be found wintering there.

Capella delicata. Wilson's Snipe. Wilson's Snipe may be found sparingly during winter, even in northern Utah, provided the spring or stream seeps and borders do not become frozen over. On December 21 four birds were seen at a seep at Spring Run, south of Salt Lake City; on the preceding day a bird was flushed from an irrigation ditch at St. George. Cottam has taken this bird near Utah Lake during Christmas week. On December 28 Williams and Sooter observed eight individuals near Brigham City. On January 11, 1942, 28 birds were seen in almost the same area. Mr. Joseph Peterson states that two alighted on a small patch of gravel exposed in deep snow at the C.C.C. Camp in Brigham City on January 12, 1942.

Numenius a. americanus. Long-billed Curlew. Curlews remained at the Refuge unseasonably late in the fall of 1941. Dr. Quortrup and personnel from the Refuge staff observed 11 on November 21. The birds were seen in one flock near the Perry cabin, Unit 5, and were probably getting ready to migrate. They were not recorded after that date.

Totanus melanoleucus. Greater Yellow-legs. This species is one of the latest fall and earliest spring migrants. One bird lingered on the Refuge until December 10, when it was last recorded by Dr. Quortrup and Dr. Sudheimer.

Limnodromus griseus scolopaceus. Long-billed Dowitcher. A single bird was seen on Unit 3, December 12, 1941, by Dr. Quortrup and Dr. Sudheimer.

Limosa fedoa. Marbled Godwit. On December 16, 1941, the writers observed at close range two Marbled Godwits on Unit 3. One bird appeared somewhat lame in one leg, although powers of flight seemed normal. These or other individuals of the same species were seen repeatedly during November and December.

Recurvirostra americana. Avocet. Nine individuals—in three groups of one, two, and six—were observed on December 16, 1941. Four were recorded on the Refuge during the Christmas census made December 21, 1939. No previous winter records for Utah are known.

Larus argentatus smithsonianus. Herring Gull. Only in recent years has the Herring Gull been observed in Utah. A number of specimens have been collected during the past 3 years. One individual was observed on the Refuge in September, two were noted on December 16, two on December 27, and one on December 28, 1941.

Telmatodytes palustris plesius. Western Marsh Wren. The 1931 Check-List states that this bird "winters from California and central Texas (casually farther north) south to Cape San Lucas, Sinaloa, and Tamaulipas." It should be reported that the bird is a common resident at the Bear River Marshes. Fairly large numbers can be seen daily. Ten individuals were seen in the tules between Unit 1 and Unit 2 on December 16, and four were observed in a tule marsh near Brigham City on December 28, 1941.

Myadestes townsendi. Townsend's Solitaire. This species is not uncommon in the mountains of Utah, although its presence in the almost treeless area of the Bear River Marshes is indeed rare. On November 19 an individual was seen to alight on a blind within 2 feet of a hunter. After a few moments the bird then rested on the back of a wooden duck decoy.

Xanthocephalus xanthocephalus. Yellow-headed Blackbird. This conspicuously colored bird normally winters from western Louisiana to Mexico. Its presence on the Bear River Refuge on December 16 is therefore worthy of record. Near it were Red-winged Blackbirds and two Brewer's Blackbirds, and not far distant were a small flock of Red-wings and at least two Cowbirds.

Notes on the Occurrence of Gulls at Utah Lake

While studying the flight activities of the Ring-billed Gull at the mouth of Provo River at Utah Lake on February 27, 1942, I noticed a large gull flying in company with the Ring-billed Gull. At first I thought it was a California Gull. As the bird came closer I decided to collect it for further identification. The bird proved to be a new record for Utah Lake and its environs. It was the Herring Gull, *Larus argentatus smithsonianus.*

With the addition of the Herring Gull to other records of gulls, we now have six species resident, at or near Utah Lake.

It is felt that the occurrence of these species is deserving of notation and I am pleased to record the following information concerning the six species of gulls from Utah Lake.

The California gull, *Larus californicus,* has been a resident of the state of Utah for a great number of years. The earliest records of explorers and pioneers to Utah report the presence of the California Gull in the northern and central part of Utah.

During the past twenty-five years there has been an increase of numbers of *Larus californicus* inhabiting Utah Lake and nesting on Rock Island.

About the time the majority of the California Gulls have migrated to the Pacific Coast (late September), the Ring-billed Gull, *Larus delawarensis* comes to Utah Valley. These birds are common residents throughout the winter. They are often mistaken for the California Gull which is a larger bird. There are, however, a few California Gulls which remain all winter but they are only seen as occasional specimens.

During the summer months it is not unusual to see a specimen or two of the Franklin Gull, *Larus pipixcan,* resting on the waters of the lake. The writer has never seen more than three specimens in one group at a time, and the most usual observation is a single specimen. These birds have been alone and have not been associated with other species of gulls or other birds. No doubt the occasional visitor to Utah Lake is one of the resident forms from Salt Lake Valley where they are known to nest.

Bonaparte's Gull, *Larus philadelphia,* was collected first at Provo Bay near Utah Lake on May 13, 1933 by C. L. Hayward and D. E. Johnson. Another specimen was collected on October 21, 1934 at Utah Lake by Mr. D. E. Johnson.

A single adult male specimen of the Glaucous Gull, *Larus hyperboreus,* was collected by Mr. D. E. Johnson on March 3, 1934. This bird was one of two birds of the same species which Mr. Johnson had under observation between February 22 and March 14, 1934.

I am indebted to Dr. Clarence Cottam of the Fish & Wild Life Service, Washington, D. C. for the verification of the Herring Gull. According to Dr. Cottam, the bird is a rare visitor to Utah and has not been noticed until the last few years.—D. Elden Beck, B. Y. U.

Gull Banding Notes at Utah Lake No. 2

For the third consecutive year young California Gulls were banded on Rock Island in Utah Lake, Utah County, Utah, on June 27, 1942.

The banding party consisted of Ray Broadbent, V. Jordan Tanner, J. C. Bement, D. E. Beck, and Vasco M. Tanner. We reached the island at 9:15 a. m. and banded three hundred birds by 12:00 noon. The bands consisted of red and yellow celluloids and aluminum Fish and Wild Life Service bands. These were placed on the legs as follows: Right leg yellow above aluminum and left leg red band. The survey bands were numbered 42-609501-609800. This year the banding was done later than previous years which resulted in great difficulty in capturing the young birds. The writers visited the island on April 11, 1942 and found that egg laying was just beginning. Many nests were being built and one egg was found on this date.

Since Report No. 1 was published[1] additional data concerning the migratory movement of the gulls banded on Rock Island in 1940 and 1941 have been sent to the writers by Dr. F. C. Lincoln of the Fish and Wild Life Service. This is briefly summarized as follows:

SURVEY RECORDS

Date of Banding	*Band Numbers*	*Location*	*Date of Observation*
June 15, 1940	40-79587	Picked up with botulism at Riverton, Wyoming by L. J. Merovka, Albuquerque, New Mexico.	August 10, 1941
	40-680208	Found dead at Crow's Landing, California by John Baty, Jr., Crows Landing, California.	March 19, 1941
	40-680031	Found dead at Tulare Lake, California by R. Dunham, Avenal, California.	December 13, 1940
	40-680553	Found dead at Newport, California by C. D. Thompson, of Hollywood, California.	May 4, 1941
	40-680675	Found dead at Milner, Idaho, by Earl Pharris of Hazelton, Idaho.	May 25, 1941
	40-680869	Found dead forty miles from Colima, Colima, Mexico, by Octavio Garcia Ibarra, Colima, Colima, Mexico.	December 1, 1940
	40-680271	Found dead at Bear River Ref., Brigham, Utah, by Vanez T. Wilson, Brigham, Utah.	August 31, 1940

1 Tanner, Vasco M., "Gull Banding Notes at Utah Lake," **Great Basin Naturalist,** Vol. 2, No. 2, page 98, June 1941.

	40-680670	Killed by airplane at Stockton, California. Reported by Norvelle Chaudron, 80th School Squadron, Stockton Field, Stockton, California.	January 25, 1942
	40-680423 40-680354 40-680221 40-680253 40-680277 40-680309	These specimens were found dead at Rock Island, Utah Lake, Utah County, Utah, by Ralph B. Williams, Salt Lake City, Utah.	September 22, 1940
June 17, 1941	41-649446	Found dead at Eureka, California, by F. S. Smith, Eureka, California.	August 2, 1941
	41-649902	Found dead at Quincy, California, by L. W. Stevenson, Quincy, California.	July 29, 1941
	41-649089	Found dead at Samoa, California, by C. J. Chirchill, Samoa, California.	September 10, 1941
	41-649560	Found dead at Savary Island, B. C., by Mrs. E. J. Pickett, Vancouver, B. C.	September 18, 1941
	41-649671	Found dead at Seattle, Washington, by E. H. Clark, Seattle, Washington.	October 13, 1941
	41-649051	Shot on Mare Island, California, by Harry Miller, Rio Vista, California.	November 24, 1941
	41-649375	Found on beach with broken wing, amputated; can't fly, still alive; at Bandon, Oregon, by Donald W. Stryker, Bandon, Oregon.	December, 1941
	41-649375	Found dead at Bandon, Oregon, by Melvin G. Alvery, Bandon, Oregon.	September 30, 1941
	41-649475	Found dead at Klipson Beach, Washington, by E. A. Flowers, Portland, Oregon.	September 10, 1941
	41-649834	Shot at Hayward, California, by Don Harder, Hayward, California.	November 3, 1941
	41-749351	Found dead at Puerto Cortes Island, Santa Margarita (west coast of California) reported by phone to F. & W. Service.	February 26, 1942
	41-649276	Captured and released at Hayward, California, by F. E. Jensen, Hayward, California.	January 20, 1942
	41-649308 41-649023 41-649508	These specimens were found dead at Rock Island, Utah, by M. M. Neal, Salt Lake City, Utah.	July 25, 1941

41-649932	"Remains found; also 1 red and 1 yellow celluloid ring," at Bird Island, Utah Lake, near Provo, Utah, by M. Vern Thurber.	November 11, 1941
	Forty one tags were recovered from dead gulls by the writers at Rock Island. The high mortality of the young banded gulls was no doubt due to the fact that many of them did not get back to their nests after banding and were killed by mature nesting birds.	July 17, 1941

During the three years, 1940, '41 and '42, we have banded 2300 specimens of young California gulls. Of this number we now have information concerning 102 individuals. These banding operations are a part of an extended study of the life history and habits of the California gull at Utah Lake.—Vasco M. Tanner and D. Elden Beck.

George Paul Engelhardt (1871-1942)

It is with deep regret that we report the passing of Mr. George P. Engelhardt, ardent student of the Argeriidae and one who endeared himself to his many friends throughout this country.

He was born in Hanover, Germany, on November 23, 1871, and died at Hartsdale, New York on May 24, 1942. He graduated from the Gymnasium at Boden Boden in 1886 and after coming to the United States became assistant curator of the Children's Museum in Brooklyn in 1902, which position he held until 1913. In 1913 he was made curator of invertebrates at the Brooklyn Museum in which capacity he labored until 1930 when he was made honorary curator.

Mr. Engelhardt early became acquainted with the western states, especially Utah. In all he made five collecting trips to this state; the first one in 1904 and the last one in 1938. As a result of my reading his interesting reports on Utah's Dixie I began corresponding with him in 1924, which continued up until the time of his death. In 1933 it was my good fortune to act as his host and companion for several days while he collected in areas around Provo; including Mount Timpanogos and Utah Lake. At this time he was in search of life history material on local species of aegeriids. After Mr. Engelhardt's return home he wrote to me under date of September 7, 1933 as follows:

> "My trip this summer has turned out very satisfactory. Must have added between a hundred and two hundred aegeriids including, what is most important to me, a number of new life histories. Wish the mounting and degreasing was done.
>
> "In telling of my summer's rambles I always like to dwell on the good times enjoyed at Provo and on Mt. Timpanogos. As you know I hold your people in the highest respect. This long established appreciation has been strengthened on my visit this summer. I hope I may be privileged to meet you and your fine family again."

It was largely through his efforts that I was able to purchase the weevil collections of Charles W. Leng and Charles F. Schaeffer. His interest in these matters and his assistance in evaluating the collections was greatly appreciated.

George Engelhardt was very fond of his wife and son. He often spoke of them in his letters and reported his son's marriage in September, 1933 to Miss Elizabeth Sherman, daughter of John D. Sherman of Mount Vernon, New York, and subsequently, February 12, 1941, announced that he was twice grandfather.

We hope that the results of his years of study of the clear-wing moths will be made available.

The following articles relating to Utah were written by George P. Engelhardt as a result of his collecting and study here:

1917. Hunting Lizards with a "Beanshooter." Copeia, No. 49. October 4, 1917. (Report of collecting seven species of lizards in Washington County by means of the "flipper" or "beanshooter."

1918. Batrachians from Southwestern Utah. Copeia, No. 60. August 18, 1918. (Reports six species taken mainly at Bellevue, Washington County in May and June 1917.)

1918. Faunal Zones in Southwestern Utah. Jour. N. Y. Ento. Soc. XXVI, p. 230.

1918. Dixieland of the Mormons. The Brooklyn Museum Quarterly, Vol. V. No. 1, June 1918. pp. 27-52. (An interesting report on collecting in Pine Valley Mountains in Washington County.)

1924. Field Work for Habitat Groups in Southwestern Utah. The Brooklyn Museum Quarterly. Vol. XI, No. 3, July 1924, pp. 116-125 and No. 4, October 1924, pp. 144-152. (A narrative of the Museum's collecting work in Utah, 1923.)—V. M. T.

Sheldon P. Hayes Collects Cold-Blooded Vertebrates in Arizona

In the spring of 1938 Mr. Sheldon P. Hayes, while teaching at the Gila Junior College in Thatcher, Graham County, Arizona, collected many interesting species of fishes and reptiles. Some of these he contributed to the herpetological collection of the Brigham Young University. Because many of these represent new records from this region for our collection, it is deemed advisable to make the following report on some of the rare species.

FISHES

Agosia chrysogaster Girard

There are 78 well-preserved specimens of this cyprinid in the collection. Many of the specimens are well colored, having a dark lateral band anterially above the lateral line but posterially on the lateral line and terminating in a dark spot at the base of the caudal fin. Dorsally the specimens are dark with a median dark stripe. Below the lateral line all the specimens are yellowish white. The teeth are 4—4, pointed and curved, without a grinding surface. The dorsal and lateral portions of the head of the males are covered with small tubercles. The measurements of the following specimens are given in millimeters; these and the scale counts were made with the aid of the binocular microscope:

Museum No.	4223	4224	4225	4226	4227	4228	4229
Sex	♂	♀	♀	♂	♀	♀	♀
Length	58	65	53	51.2	57	59	55
Head	14.5	16	13	13.5	14	15	13
Scales	18-87-14	18-93-14	17-85-14	17-86-14	17-85-14	18-90-14	18-83-14
Eyes	3	4	2.8	3	3	3	3
Depth	14	16	13	11.5	13.3	13.7	12.5
Dorsal	I-8	I-8	I-8	I-8	I-8	I-8	I-8
Anal.	I-7	I-7	I-7	I-7	I-7	I-7	I-7

SNAKES

Salvadora grahamiae hexalepis (Cope)
Arizona elegans occidentalis Blanchard
Thamnophis eques (Reuss)
Thamnophis marcianus (Baird and Girard)
Tantilla wilcoxi Stejneger
Micruroides euryxanthus (Kennicott)
Crotalus viridis viridis Rafinesque.—V. M. T.

Notes on the Birth and Growth of Horned Lizards

On July 25, 1942 Mr. Wilmer W. Tanner collected a female horned lizard, *Phrynosoma douglassii ornatum* Girard, at Indianola, Sanpete Co., Utah. This is 38 miles southeast of Provo on Thistle Creek, a tributary of the Spanish Fork River, which flows into Utah Lake. This specimen which was given to the writer, was placed in a glass jar in the laboratory on July 31. It was kept under observation until the afternoon of August 7, when I saw some little lizards moving around, some of them on the back of the mother lizard. I counted seven young and within a half hour the eighth one was born.

Professor H. J. Pack (1) in 1916 collected several female horned lizards west of Salt Lake City, which he kept in cages. On August 14th, two females had given birth to living young and another one on August 16th.

These records agree with field observations that have been made for the past twenty years; namely that the horned lizards of this area gives birth to living young during the late summer and early fall months and that the young lizards do some feeding, doubling or trebling their weight before hibernation.

For the purpose of determining, in a general way, the rate of growth of the young, during the first year, the eight little lizards were weighed 15 hours after birth. The results are shown as follows:

No. 1 0.60 of a gram	No. 5 0.50 of a gram
No. 2 0.82 of a gram	No. 6 0.75 of a gram
No. 3 0.90 of a gram	No. 7 0.76 of a gram
No. 4 0.80 of a gram	No. 8 0.79 of a gram

Total 5.92 grams

The female weighed 13 grams after the birth of the young.

The following are the weights of 12 young specimens of this same species collected at the Desert Experiment Station, 50 miles west of Milford, Beaver Co., Utah, on September 4, 1937, by the writer.

No. 1 2.00 grams	No. 7 1.80 grams
No. 2 2.00 grams	No. 8 1.65 grams
No. 3 3.00 grams	No. 9 2.00 grams
No. 4 2.20 grams	No. 10 1.55 grams
No. 5 2.15 grams	No. 11 1.55 grams
No. 6 2.10 grams	No. 12 1.60 grams

These specimens, no doubt, belonged to a number of litters, as they were collected within a radius of two to three miles of the station. I am also of the opinion that they were more or less than four weeks old and that they had in this time doubled to trebled their weight. An examination of the stomachs of the above specimens shows that their food consisted of ants, in the main (95%). At least three species were common in the diet; one of these being *Pogonomyrmex barbatus* var. One stomach contained two specimens of *Blapstinus* sp.—V. M. T.

(1) H. J. Pack, **Copeia,** No. 63, Nov. 21, 1918. pp. 91-92.

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NEW CENTURY PRINTING CO., PROVO, UTAH

VOLUME III NUMBERS 3 AND 4

The Great Basin Naturalist

December 31, 1942

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Published at Provo, Utah, by the
Department of Zoology and Entomology of
Brigham Young University

The Great Basin Naturalist

Vasco M. Tanner, *Editor*

C. Lynn Hayward, *Assistant Editor*

A journal published four times a year by the Department of Zoology and Entomology, Brigham Young University, Provo, Utah.

Manuscripts. Only original unpublished manuscripts, pertaining to the Great Basin and the Western United States in the main, will be accepted. Manuscripts are subjected to the approval of the editor.

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Subscription. The annual subscription is $1.50, (outside the United States, $2.00). Single number, 50 cents.

All correspondence dealing with manuscripts, subscriptions, reprints and other business matters should be addressed to the Editor, Great Basin Naturalist, Brigham Young University, Provo, Utah.

Reprint Schedule of The Great Basin Naturalist

	2 pp.	4 pp.	6 pp.	8 pp.	10 pp.	12 pp.	Each Additional 2 pp.
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300 copies	5.75	6.75	7.75	8.75	9.75	10.75	

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The Great Basin Naturalist

Published by the
Department of Zoology and Entomology
Brigham Young University, Provo, Utah

Volume III | DECEMBER 31, 1942 | Nos. 3 & 4

BREEDING RECORDS OF UTAH BIRDS[1]

79,665

ROBERT G. BEE, Provo, Utah
and
JOHN HUTCHINGS, Lehi, Utah[2]

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The breeding records of Utah birds appearing in this report are the result of field observations extending over a period of approximately 17 years from 1926 to 1942 inclusive. Most of the work has been carried out in spare time in Utah County, especially in the vicinity of Utah Lake, but considerable data are also available from Salt Lake and Davis counties as well as scattered localities within the borders of the State.

In the main, it may be said that most of the records here presented represent sets of eggs collected. These eggs have been carefully preserved and the data accurately recorded. Both eggs and data repose in the private collections of the authors and at Brigham Young University. In addition to the ones collected there are included numerous records of nests and eggs observed and recorded *in situ*.

The nesting data are arranged according to counties, specific localities and dates. Where more than one record is available for any date the appropriate number is placed in parentheses following the date. Observations of the two authors are designated by (B) for Bee and (H) for Hutchings. A few records from Brigham Young Uni-

(1) Contribution No. 103 from the Department of Zoology and Entomology, Brigham Young University, Provo, Utah.

(2) It is fortunate that we are able to present for publication at this time a summary of the ornithological work of two of Utah's most enthusiastic and energetic bird students. It has been my pleasure to associate with both Mr. Bee and Mr. Hutchings for a number of years. I have been in the field with them on many occasions and can personally vouch for their intimate knowledge of Utah's avifauna as well as the meticulous care with which their observations have been made and recorded. Both men have been connected with us at Brigham Young University for a number of years and have contributed much to our mounted bird and zoological collections. Mr. Hutchings is an accomplished taxidermist and has contributed life history displays of several species of birds which are now on exhibit. James W. Bee and Harold Hutchings, sons of the two writers and now serving in the U. S. armed forces, have both been students at Brigham Young University and have contributed materially to our natural history collections through field expeditions conducted by the University.—C. Lynn Hayward.

versity, not previously published are included and indicated by (Y). Comments pertaining to nesting habits and most active nesting periods are made whenever sufficient data are at hand. Notes on the construction of nests and typical nesting habits apply only to particular cases observed and should not be construed to refer to the habits of a species in general.

The nesting dates given do not necessarily indicate the beginning of the nesting process since in some instances the eggs when collected were far advanced in incubation. Late dates are often accounted for by a second clutch being laid when the first set is lost by inundation, vandalism, scientific collecting or any of the many catastrophies that befall nesting birds.

The writers wish to express appreciation to their sons, James W. Bee and Harold Hutchings who have assisted in the collection and preparation of the data, and to Dr. C. Lynn Hayward of Brigham Young University who has collaborated in the compilation and editing of the manuscript.

LIST OF BREEDING RECORDS OF UTAH BIRDS

Colymbus nigricollis californicus (Heermann). Eared Grebe. *Utah County:* 1 mile south of outlet, Provo Bay, May 28 (B); north end, Utah Lake, June 30 (H). *Salt Lake County:* Black Slough area, June 5 (B). *Davis County:* Mouth of Jordan River, June 5 (B). *Wasatch County:* east end Strawberry Lake, July 27 (50) (H).

Nests observed were composed of floating masses of dead, water-soaked rushes or grasses attached to tules or grasses slightly depressed to hold the eggs. They were located near the margins of lakes where the water depth was about one foot and near the source of food.

Aechmophorus occidentalis (Lawrence). Western Grebe. *Utah County:* Mouth of Spring Creek, May 12 (B); South of Lehi, June 16 (nest ready for eggs) (H).

Nests were floating platforms of partly decayed rushes depressed on top to receive the eggs. They were placed in water about 18 inches deep near the margins of streams that meander through fields of rushes or vegetated shallows of lakes where the food supply is abundant.

Podilymbus podiceps podiceps (Linnaeus). Pied-billed Grebe. *Utah County:* West side Utah Lake, June 30 (H). *Salt Lake County:* Black Slough, June 5 (B); *Wasatch County:* North end of Strawberry Lake, July 26 (3) (B), July 27 (125) (H).

The nests observed were floating masses of dead rushes with mud added to the slight depression. A large colony, estimated at 125 pied-billed and 50 eared grebes, was visted at Strawberry Lake, July 27, 1938. On the following day a high wind destroyed almost all of them and hundreds of eggs could be seen on the bottom of the lake in 10 to 14 inches of water.

Pelecanus erythrorhynchos Gmelin. White Pelican. *Tooele County:* Hat Island, Great Salt Lake, May 16 (B).

Nests were slight depressions in the ground, occasionally with a few weed stems at the rim.

Phalacrocorax auritus auritus (Lesson). Double-crested Cormorant. *Salt Lake County:* Egg Island, Great Salt Lake, May 15 (5) (B). *Cache County:* five miles west of Logan, May 13 (Y).

Nests on the island were rude masses of weed and sage sticks depressed to hold the eggs and heavily coated with excrement from the birds. The Cache Valley colony nested in dead trees along the banks of Little Bear River in company with Treganza's heron. The nests of the cormorants were on the lower branches while those of the herons were higher up.

Ardea herodias treganzai Court. Treganza's Heron. *Utah County:* near mouth of Hobble Creek, Provo Bay, April 14 (5), 15 (3), 16 (2), 19 (6), May 7 (8) (BHY); south of Lehi, April 20 (H); 8 miles south of Pelican Point, Utah Lake, May 1 (H). *Cache County:* Little Bear River, 5 miles west of Logan, May 13 (Y) (young in nest).

Nests are platforms of sticks either on limbs of cottonwood trees or in marshes. A large colony of these herons formerly occupied a grove of cottonwood trees on the west shores of Utah Lake, 8 miles south of Pelican Point. When the colony was visited, May 1, 1923, then nests were placed so close in the trees that they appeared as a solid mass from a distance. Due to cutting of trees and persecution this site has now been abandoned.

Egretta thula brewsteri Thayer and Bangs. Brewster's Egret. *Utah County:* Marsh area east of Provo Bay, May 4, 8 (4), 12 (2) (B); Utah Lake west of Springville, April 19 (H). *Salt Lake County:* Black Slough area, April 29 (6) (B).

In the area studied the nests are platforms of dead rushes, slightly depressed at the top, and built up about 18 inches above the water in marsh areas near open water. Nests of this species average about 10 inches higher above the water than the following.

Nycticorax nycticorax hoactli (Gmelin). Black-crowned Night Heron. *Utah County:* Mouth of Hobble Creek, Provo Bay, April 15 (3), 16, 19, (7) (BH), May 4 (2), 6, 8 (2), 7, 12 (BH). *Salt Lake County:* Black Slough, May 9 (2) (B).

Nests are composed of mats of weed stalks and sticks built up approximately 10 inches above one foot of water.

Botaurus lentiginosus (Montagu). American Bittern. *Utah County:* Slough southwest of Provo, May 9 (B); slough and stream margin near Lehi, May 17, June 4 (B); vicinity of Lehi, May 1, 15, 20, 31, and June 1 and 4 (H).

Nests are composed of dead rushes, built in and over water about 16 inches deep. In many instances a runway of rushes connects the nest with the water level. The usual nesting habitat is swamp areas near streams.

Plegadis guarauna (Linnaeus). White-faced Glossy Ibis. *Salt Lake County:* Black Slough area, May 29 (17), June 13 (2) (B). *Boxelder County:* Bear River Marshes, May 6 (B).

Nests are rude masses of new and (or) last year's tules and attached to growing tules. They are placed above about 22 inches of water.

Branta canadensis canadensis (Linnaeus). Canada Goose. *Utah County:* Provo Bay area, April 2, 11, 12 (2), 19, 26, and May 1 (B); Rock Island, Utah Lake, April 9 (B). *Davis County:* Farmington Bay, April 28 (3) and May 6 (B).

Large nests composed of old tules and with the depressions lined with bits of rushes, down and feathers. Nests are found on small islands or broken down rush mats.

Anas platyrhynchos platyrhynchos Linnaeus. Common Mallard. *Utah County:* Provo Bay area, April 10, 18, 19 (BY), May 5 (Y), June 8 (B). *Davis County:* Farmington Bay, April 5, 15 (5), 28 (4), May 6, 8, 27 (B) and June 13 (2) (B). *Salt Lake County:* Halloran Duck Club, April 9 (B).

Nests are composed of coarse grasses lined with finer grasses and feathers. They occurred on grown over accretion ground near stream, pond or lake.

Chaulelasmus streperus (Linnaeus. Gadwall. *Utah County:* Rock Island, Utah Lake, June 1 (B). *Davis County:* Farmington Bay area, June 25 (B).

The Rock Island nest was composed of tule stems and feathers and placed in a slight depression. It was approximately 150 feet from water.

Dafila acuta tzitzihoa (Vieillot). American Pintail. *Utah County:* North margin of Provo Bay, April 15 (B). *Davis County:* Farmington Bay area, April 15 (B).

Nests were composed of rushes and weeds and lined with down. They were found among weeds about 30 feet from the lake.

Nettion carolinense (Gmelin). Green-winged Teal. *Davis County:* Farmington Bay, May 6 (B). *Utah County:* Utah Lake, April 28 (H).

Grass and weeds lined with down compose the nests. They were found in marsh areas near streams.

Querquedula discors (Linnaeus). Blue-winged Teal. *Utah County:* North margin of Provo Bay, May 24 (B). *Davis County:* Farmington Bay, May 16 (B).

The Provo Bay nest was a cup of grasses lined with feathers. It was about 20 feet from a marsh area near the confluence of a stream and the lake.

Querquedula cyanoptera (Vieillot). Cinnamon Teal. *Utah County:* Provo Bay area, May 28, June 3, 8 (B); Lakeview, May 13 (Y). *Salt Lake County:* Black Slough, May 6 (B). *Davis County:* Farmington Bay, April 28 (2), May 13 (2), 27, and June 13 (3), August 9 (2) (B).

Nests are composed of dry grasses lined with down.

Spatula clypeata (Linnaeus). Shoveller. *Davis County:* Farmington Bay, April 30 and May 6 (B).

The nests were depressions in the ground with the rims formed of weed stems and the cups lined with down. They were located in a pasture area a few feet from a water-filled borrow pit.

Nyroca americana (Eyton). Redhead. *Utah County:* north margin of Provo Bay, April 15 (B). *Davis County:* Black Slough area, May 7, June 4, 5 (B).

Nests were placed over water about one foot deep. They were composed of masses of dry rushes fastened to tules. A few feathers were in the cup.

Erismatura jamaicensis rubida (Wilson). Ruddy Duck. *Salt Lake County:* Black Slough, June 5 (B); Halloran Duck Club, June 5 (H). *Davis County:* Marsh north of Jordan River, June 5, 10 (B).

Nests were over about 10 inches of water. The base was made up of old rushes topped with bayonet grass and neatly cupped. A few feathers of the bird were in the cup. In one case the nest was cupped in a mass of water-soaked rushes.

Mergus serrator Linnaeus. Red-breasted Merganser.[3] *Salt Lake County:* property of Jordan Fur and Reclamation Company, June 7 (a female with young on the lake was reported to Mr. Bee by A. Bater). On June 13, 1936 a parent and 3 young was seen in the Jordan River, Black Slough Area by R. G. Bee and Arthur Bater.

Cathartes aura septentrionalis Wied. Turkey Vulture. *Utah County:* Cave in Hobble Creek Canyon, May 26, June 5, (11) (B).

This nesting site was in a cave about 12 miles up the canyon. The eggs were placed on the bare ground.

Astur atricapillus atricapillus (Wilson). Eastern Goshawk. *Utah County:* Head of Slate Canyon, May 16 (B); Mutual Dell, American Fork Canyon, May 17 (H); Deer Creek, American Fork Canyon, May 17 (H); Silver Lake, American Fork Canyon, April 20 and May 21 (H); Slide Canyon, Maple Flat, May 21 (B); American Fork Canyon, May 26 (H); Aspen Grove, Mt. Timpanogos, June 5 (Y); Salamander Lake, June 7 (Y); Altamont, Mt. Timpanogos, June 10 (H). *Salt Lake County:* Doty Gulch, Bingham Canyon, May 16 (B).

Nests are bulky masses of sticks, slightly cupped to hold the eggs. Bits of conifer or aspen bark are often in the cup. The nests are built both in conifer and aspen trees usually 35 feet or more up, and they are generally near the trunk of the tree or in the forks.

Accipiter velox velox (Wilson). Sharp-shinned Hawk. *Utah County:* Box-elder Canyon, northeast of Alpine, May 25 (B); Alpine Canyon, May 29, 30 (BH); Alpine Canyon, June 4 (H); Provo River Bottoms, June 9 (B); Hobble Creek Canyon, June 6 (B); Maple Canyon, June 18 (B); two miles north of Lehi, June 20 (H); near Vivian Park, July 24 (H). *Salt Lake County:* Dry Fork of Bingham Canyon, June 3, 19 (B); Butterfield Canyon, June 21 (B).

The nests are platforms of aspen, conifer or other twigs depressed to hold

(3) Although the breeding status of the red-breasted merganser is based upon sight records and the close field resemblance betweeen the females of the American and red-breasted is recognized, it is not unlikely that the birds in question were red-breasted mergansers and that this species does breed in small numbers within the State. Mr. Bates who lives at Jordan Fur and Reclamation Company has frequently seen males and females of this species together throughout the summer and Mr. Bee has had the same experience. It is often stated (see for e. g. Peterson, A Field Guide to Western Birds, 1941, p. 38) that the red-breasted merganser is rare "in the Great Basin and Rocky Mountain Region.' My own experience in the vicinity of Bear Lake, Utah-Idaho, and Utah Lake does not bear out the concept that this merganser is rare in Utah. In three years of bird work in Bear Lake Valley I did not often encounter the American merganser although the red-breasted was a common spring and fall migrant. I have also occasionally found males and females in pairs during the nesting season in that area. Out of 13 specimens of mergansers in the Brigham Young University collection, taken at various localities in Utah, about half are red-breasted.—C. L. H.

the eggs. Bits of bark are found in the cup. They are placed 12 to 15 feet up (occasionally higher) in a bush or tree in wooded areas.

Accipiter cooperi (Bonaparte). Cooper's Hawk. *Utah County:* Cedar Valley area, May 17, 18, 23, 27, and June 25 (H). *Salt Lake County:* Barney Canyon, Oquirrh Range, June 1 (B); Dry Fork of Bingham Canyon, May 24 and June 2, 5 (B); Butterfield Canyon, May 15 (B). *Davis County:* Mill Creek Canyon, southeast Bountiful, June 2 (B).

Nests are bulky masses of sticks lined with bits of bark or hay usually in oak or other trees in thicket areas near streams. In two cases, nests were located on great piles of tumble weeds and the nests themselves were composed of tumble weeds. In two other cases old magpie nests were utilized.

Buteo borealis calurus Cassin. Western Red-tailed Hawk. *Utah County:* Diamond Fork of Spanish Fork Canyon, April 11 (B); Slate Canyon, April 15 (B); Lake Mountain, April 2, 21, 26, 16, 17, 6, 20, and June 4 (BH); Cedar Valley area, April 9, 17, 26, 21, 30, 2, and June 15 (BH); Dry Canyon, Mt. Timpanogos, April 3 (Y); Big Tree Camp, Mt. Timpanogos, June 5 (young) (Y); north of Lehi, May 9 (H); east of Moseda, May 2 (H). *Wasatch County:* Strawberry Valley, May 30, 25 (B); Wallsburg Switch, April 27 and May 4 (B); Charleston, May 4 (2), 6 (B); Strawberry Valley, May 25 (B); Wallsburg, April 20 (B). *Salt Lake County:* Doty Gulch, Bingham Canyon, May 14 (B).

Nests are bulky structures composed of sticks and lined with bits or strips of bark or sometimes hay. In mountainous areas they are placed in cliffs or high in trees. In the desert, tops of junipers or rocky ledges are used.

Buteo swainsoni Bonaparte. Swainson's Hawk. *Utah County:* 7 mile Pass, Cedar Valley, April 20, 29, and May 25 (H); near Elberta, May 16 (H); west slope of Lake Mountain, May 9 (H); west of Saratoga, May 3 (H). *Tooele County:* Orr's Ranch, May 2 (nest ready for eggs) (B). *Wasatch County:* Wallsburg Switch, May 4 (B); Strawberry Valley, May 25 (B).

The usual nesting site is in the top of a juniper on a hillside overlooking sage and grease-wood flats. Nests are masses of sticks lined with juniper bark.

Buteo regalis (Gray). Ferruginous Rough-leg. *Utah County:* Goshen Pass, April 9, 8 (BH); west side Lake Mountain, April 10, 1, 8, 22, 6, 9, 7, 15, 30 and May 1 (BH); east side Lake Mountain, April 22 (B); Cedar Valley area, March 3, April 6, 14 (4), 17, 9, 15, 12, 8, 26, and January 15[4] (H); sand knolls west of Utah Lake, May 1 (H); south of Moseda, April 16 (H). *Tooele County:* north end of Rush Valley, April 2 (3) (H); Orr's Ranch, May 2 (2) (H); 5 mile Pass, April 11 (B); SW Mercur, April 26 (B); west slope of Stansbury Range, April 20 (B); Oquirrh Range, April 27 (2) (B). *Salt Lake County:* Parley's Canyon, April 27 (B).

Nests are bulky masses of sticks lined with juniper bark. They usually contain considerable other material such as cattle dung, wool and newspapers. They are generally placed in low junipers but in mountainous areas may be placed in high trees or on ledges.

(4) The January 15, 1935 nesting record is extremely interesting. The record was made by Mr. Hutchings who states in his notes that the bird was found on the nest. A set of 2 eggs was collected. The nest was composed of sticks and tumble weeds and was well lined with bark. It was situated about 7 feet up in a small juniper. This early nesting date coincides with the mild winter and extremely early spring of 1935.—C. L. H.

Aquila chrysaetos canadensis (Linnaeus). Golden Eagle. *Utah County:* Boxelder Canyon, east of Alpine, March 18 (B) and April 23 (H); east slope of Lake Mountain, March 28, and April 4, 12 (B); Grove Canyon, Mt. Timpanogos, April 2, 10, 19 and May 2 (eggs hatching) (B); Y Mountain, east of Provo, June 18 (young in nest) (B); Wildwood, Provo Canyon, April 2, 31 (B); Goshen Pass, April 9, 21 (BH); Diamond Fork, Spanish Fork Canyon, April 24 (B); Pole Canyon, Cedar Valley, April 21 (B); Lehi Mountain, April 4, 7 (H); 5 Mile Pass, April 14, 16 (H). *Tooele County:* Oquirrh Range, April 23 (young and pipped egg) (B) and May 9 (two young reported by H). *Davis County:* Antelope Island, Great Salt Lake, March 23 (B). *Millard County:* 8 miles south of Kanosh, March 20 (B).

In desert areas the nests are composed of sage, conifer or other available sticks lined with juniper and sage bark strips. Occasionally other material such as wire or newspapers are found in these nests. In conifer and aspen communities the nests are made of coarse sticks with occasionally a few corn stalks, topped with several inches of new conifer boughs depressed to hold the eggs. Nesting sites in desert regions are in juniper trees or shelves of cliffs; in mountains, trees or niches in cliffs are used. The same nest may be used year after year unless disturbed, but a pair of birds may have as many as three nests in the same general area.

Circus hudsonius (Linnaeus). Marsh Hawk. *Utah County:* Marsh area, vicinity of Lehi, May 3, 4, 11, 12 (2), 22, 25 (2), and June 7, 19, 20, 29, 30 (H); vicinity of Provo Bay, April 10, 18, 20, 23 and May 1, 19 (2) (B). *Salt Lake County:* Barney's Canyon, April 20 (B).

Nests are placed on the ground, on slight elevations in a marshy area or on broken-down rushes over water. They are composed of old matted rushes, grasses or weed stalks.

Pandion haliaetus carolinensis (Gmelin). Osprey. *Duchesne County:* Mirror Lake, Uinta Mountains, August 24 (a single fully fledged young was seen at the rim of the nest) (B). *Summit County:* Trial Lake, Uinta Mountains, July 19, 30 (adults were seen carrying fish to a nest overlooking the lake) (Y). *Sevier County:* Rock Creek Basin near Fish Lake, July 22, 1928. This nest was situated about 60 feet up in a dead fir tree. Birds were seen at the nest (B).

Falco mexicanus Schlegel. Prairie Falcon. *Utah County:* Chimney Rock Pass, April 3, 15, 17, 23 (BH); Lake Mountain vicinity, March 3, April 2, 7 (2), 8, 9 (2), 14 (2), 16 (2), 17, 18 (2), 20 (2), 21 (2), 22 (2), 26 (BHY). May 1, 2 (2), (H), and June 15 (H); 5 Mile Pass, April 8 (B); Boxelder Canyon east of Alpine, April 20 (B); creek north of Lehi, May 3 (H); Cedar Valley, April 6, 10 (H); Dry Canyon, Mt. Timpanogos, May 6 (Y); Goshen Pass, April 12 (H).

Shelves or niches of rocky ledges are used as nesting sites. The eggs are placed on the bare ground or the nest of a raven may be utilized.

Falco peregrinus anatum Bonaparte. Duck Hawk. *Utah County:* Lake Mountain near Pelican Point, May 20, 1935 (H).

The eggs were placed on bare ground on a ledge overlooking Utah Lake. There were four in number and fresh at the time of collection. Mr. Cedarstrom who lives at Pelican Point reports that the birds have nested there for

many years. One of the birds was collected to verify identification and is now in the collection of John Hutchings.

Falco sparverius phalaena (Lesson). Desert Sparrow Hawk. *Utah County:* west of Provo, May 20 (B); vicinity of Lehi, May 9, 14, 12, 16, 17, 24 (2), 26, 92 (4) (BH). *Salt Lake County:* Ft. Duchesne, May 17 (B). *Wasatch County:* Charleston, May 15 (2), Wallsburg Switch, May 28 (B). *Davis County:* Centerville, June 3 (B); Farmington Bay, June 2 (B). *Boxelder County:* Brigham City, May 6 (B).

Nests are generally placed in a cavity of a tree or in an old magpie nest.

Dendragapus obscurus obscurus (Say). Dusky Grouse. *Utah County:* American Fork Canyon, June 6 (young in natal plumage) (B); east of Power Plant, Alpine, June 4 (empty shells), June 1 (eggs pipped) (H); West Canyon, west of Lehi, May 30 and June 11 (hatching) (H); west face, Mt. Timpanogos, June 8 (B); near Soldier Summit, May 30 (B).

Nests found were scratched out cups lined with dry leaves and a few feathers of the incubating bird. They were found on high ridges.

Bonasa umbellus ssp.(5) (Douglas). Ruffed Grouse. *Utah County:* On May 17, 1942 a nest was discovered by C. L. Hayward and R. G. Bee, in a small hollow south of Aspen Grove, Mt. Timpanogos. The nest was at the base of a bent aspen on a gently sloping area and consisted of a hollow scooped out of dry aspen leaves. It was quite damp from recent storms. Four eggs were in the nest, and three of them were buried somewhat in the leaves and stained as if they had been there for some time. The site was marked and revisited May 23 at which time the nest contained 7 eggs. This time the nest showed more evidence of continued use. The bulk of it was dry aspen leaves lined with a few branches, twigs, and 2 or 3 feathers.

Centrocercus urophasianus (Bonaparte). Sage Hen). *Utah County:* hills in north end of Cedar Valley, May 16 (B); Tickville, Cedar Valley, May 16 (H), 1 (H); West Canyon, west of Lehi, June 10 (H). *Wasatch County:* Strawberry Valley, May 10, 15, 29, 30 (BH); Wallsburg, June 7 (H). *Morgan County:* April 29 (B).

Nests are slight hollows or scratched out cups sparsely lined with feathers, hay and weed stems and placed at the base of a sage ridge of valley, or slope.

Lophortyx californica californica (Shaw). California Quail. *Utah County:* vicinity of Provo, May 24, 30, June 11, and July 13 (B).

Nests are scratched out cups sparsely lined with feathers and (or) dry leaves and grasses in sheltered situations under logs or in thickets.

Phasianus colchicus torquatus Gmelin. Ring-necked Pheasant. *Utah County:* vicinity of Provo Bay, May 13, 24, 28 (B); Lehi, June 8 (B).

The usual nesting sites are weed patches, rushes, hedgerows or thickets. Nests are cups in the ground lined with feathers or stalks of weeds. Duck's nests are occasionally used.

Grus canadensis tabida (Peters). Sandhill Crane. *Juab County:* Fish

(5) According to information received from John W. Aldrich, the ruffed grouse of our locality have been recently placed in a new subspecies. However, the new name is not available to us at this writing.—C. L. H.

Springs area, April 30 and May 4 (BH). *Utah County:* noted adult with young in the vicinity of Lehi, season of 1939 (H.)

Nests observed were platforms of bayonet grass with two or three stray feathers and were in and above water. They were placed in small clearings in a bayonet grass marsh near a spring creek.

Rallus limicola limicola Vieillot. Virginia Rail. *Utah County:* vicinity of Lehi, May 25, 22 (H); June 4 (2), 18, 19 (HB).

These nests were composed of old marsh grass or cat-tails, recessed to hold the eggs. They were partially hidden by overhanging marsh growth, over water, or among grasses of wet meadows.

Porzana carolina (Linnaeus). Sora. *Utah County:* Lehi, June 4 and 7 (BH). *Wasatch County:* Charleston, May 30 (B); Wallsburg, June 7, 9 (3), 11 (HB). *Salt Lake County:* south of Salt Lake City, June 2 (B).

Generally the nests have been found in the growth of marsh, bog, or inundated pasture. They are cups formed from dead grasses or flags.

Fulica americana americana Gmelin. American Coot. *Utah County:* west of Springville, May 27, 28 29 (B); Lehi, April 28, and May 29 (B); Provo Bay area, April 15 and May 15 (B). *Boxelder County:* May 28 (Y). *Davis County:* May 27 (6), 19, 13 (3), 6 (4), June 4 (10), and July 1 (B). *Salt Lake County:* Black Slough, May 16 B).

Nests consist of rushes matted and depressed to hold the eggs. Often a runway of rushes connects the water level with the nest. Typical nesting areas are marsh growths near the margins of creek, slough or lake.

Charadrius nivosus nivosus (Cassin). Western Snowy Plover. *Utah County:* Provo River near outlet to lake, July 5 (B); Utah Lake west of Provo, April 25 (H); June 6 (2) (B); Pelican Point, Utah Lake, April 25 (H). *Davis County:* mouth of Jordan River, May 15 (B); Farmington area, April 23, 25, 28, May 2, 4, 7 (2), 13 (2), 19, 27, June 7 (5), 10, 13, 23 (B). *Salt Lake County:* Crystal Duck Club, April 22 (B); Black Slough area, May 13 (3), 5, 17, 23, 4, and June 8 (B). *Boxelder County:* Chesapeake Lake, June 10 (B).

Nests are slight depressions in the ground sparsely rimmed with pebbles, concretion chips, shells, weed stems and similar objects. They may be placed in the center of roads or along dykes, beaches or on accretion grounds.

Oxyechus vociferus vociferus (Linnaeus). Killdeer. *Utah County:* west of Springville, May 22 (B); Lake Shore, April 28 (B); Provo Bay Area, May 15 (Y); Lehi vicinity, April 20, 23, May 1, 4, 8, 19 (2), 10, 25, 28, 29 (2), June 4 (2), 16, and July 2 (H). *Salt Lake County:* Black Slough area, March 23 (2), April 14 (2), 15, 16 (2), 20, 22, 26 (2), 29, and May 4, 5 (B); Halloran Duck Club, April 9 (B). *Davis County:* Jordan River, May 7 (B); Farmington Bay, April 22, 25, 26, 28, 30, May 2, 8, 7, 13, 19 (5), and June 13 (2) (B). *Summit County:* Upper Weber River (7000 feet elevation), June 4 (B). *Wasatch County:* Wallsburg, May 19 (B).

Favorite nesting areas are short grass pastures, canal banks, edge and center of roadways or on furrows or recedes of lakes or ponds. The nests are slight depressions with chips of stone, wood or small sticks at the rim.

Capella delicata (Ord). Wilson's Snipe. *Utah County:* Lehi vicinity, April

15, 20, 26 (H), May 4, 12 (2), 14 (4), 15 (3), 17 (3), 18 (2), 20 (3), 23, 25, 27, 29, 30 (HB), June 1, 2 (2), 4, 10, 18, 25 (2) (HB); South of Provo, May 5 (2), 6, 12, 15, 17, 14, 23 (3), 25, 26, and June 1 (YB). *Salt Lake County:* south of Midvale, June 30 (B). *Wasatch County:* Wallsburg vicinity, May 8, 13 (4), 15, 21 (6), 19, 29, 30 and June 5, 7, 11 (2) (BH).

The nest is a cup of dried grass placed in a tussock in a boggy pasture area near a spring source.

Numenius americanus americanus Bechstein. Long-billed Curlew. *Utah County:* Provo Bay area, May 1 (2), 2, and April 26 (B); Lehi vicinity, April 20 (2), May 1 (2), 4, 5 (2), 9, 27 (H); Mosida, May 1 (2), 10 (H); Pelican Point, Utah Lake, May 26 (H); *Salt Lake County:* west of Salt Lake City, April 23 (3) (H); Black Slough area, April 22 (2), 26, 29 (2), and May 4 (2), 20 (3) (B); Halloran Duck Club, April 22 (6) (B). *Tooele County:* west of Salt Lake City, April 7 and May 5 (B); NE of Magna, April 25 (B). *Davis County:* Farmington Bay area, May 5, 16, 17, 13 (2), 24, 27 (2) (B). *Boxelder County:* pasture east of Bear River Refuge, May 6 (B).

Usual nesting sites are short grass pastures or greasewood flats contiguous to a lake, slough or stream. The nests are natural hollows, slight depressions or cups in the ground lined with varying amounts of hay or weed stems.

Actitis macularia (Linnaeus). Spotted Sandpiper. *Utah County:* Rock Island, Utah Lake, June 4, 9 (2) (B); Lehi vicinity, June 15, 14, 23, 16, and July 3 (H); North Fork of American Fork Canyon, July 6 (H). *Wasatch County:* Strawberry Valley, July 7 (B); Wallsburg, June 11 (B); Park City, June 13 (B); Lost Lake, Uinta Mountains, June 19 (Y). *Sevier County:* Fish Lake, June 16 (B). *Summit County:* Upper Weber River, June 5 (2), 14 (2) (B). *Davis County:* Farmington Bay area, May 13, 19 (young) (B).

Nests are depressions lined with hay and are placed near water by a bush, boulder, or among last year's marsh grass.

Catoptrophorus semipalmatus inornatus (Brewster). Western Willet. *Utah County:* Mosida, Utah Lake, May 27 (H); Lehi, May 9 (H); Cedar Valley, May 24 (H); Pelican Point, Utah Lake, May 4 and June 3 (H); Provo Bay Reef, June 21 (downy young) (B). *Davis County:* Farmington Bay area, April 23 (nest ready for eggs), May 4, 11, 14, 16 (2), 17 (B); margin of Jordan River, May 7 (B). *Salt Lake County:* Black Slough area, April 29, May 5, 9 (2), 8, 11 (2), 14, 17, 20 (B); Crystal Duck Club, April 22 (2) (B).

Lowland pasture areas and marginal lands are usual nesting sites. The nest is of hay neatly cupped in and above ground.

Recurvirostra americana Gmelin. Avocet. *Utah County:* Provo Bay area, April 5, 29 (5), May 7, 25, and June 1 (3), 8 (2), 17 (3), 21 (34) (BHY); Lehi vicinity, May 11, 22 (3), and June 1 (H); Mouth of Provo River, June 26 (Y); Rock Island, Utah Lake, May 28 (H); Mouth of Spring Creek, Utah Lake, June 1 (H); Pelican Point, Utah Lake, May 30 (H). *Salt Lake County:* Black Slough area, April 15 (3), 26 (2), 22, 29 (2), May 2, 4 (4), 6, 7 (3), 11 (2), 14, and June 3 (B). *Davis County:* Delta of Jordan River, April 24, and May 7 (4) (B); Farmington Bay, April 27, 28 (11), and May 4 (13), 6 (90), 8 (2), 10, 13, 14, 18 (2), 19 (5), 20 (25) (B).

Nests are slight depressions in the ground lined with varying amounts of hay

or weed stalks, or they may be built up above the ground of the same materials. They are placed on damp recedes, dykes, ditch banks, lowland roads, accretion areas, or short grass pastures near water.

Himantopus mexicanus (Müller). Black-necked Stilt. *Utah County:* Provo Bay area, June 1, 17 (2), 21 (4) (B); Utah Lake, June 1 (H); Mouth of Provo River, June 26 (Y). *Salt Lake County:* Black Slough area, April 15, 29 (2), May 3, 9, and June 8, 15 (2) (B). *Davis County:* Farmington Bay area, May 10 (2), 4 (3), 18, 23, 27 (B).

Construction of the nests is very similar to those of the avocet. They have been found about the borders of sloughs, marshes and lakes as well as inundated pasture grounds.

Steganopus tricolor Vieillot. Wilson's Phalarope. *Utah County:* Lehi vicinity, May 4, 23, 24, and June 10, 11, 16 (H). *Wasatch County:* Charleston, June 15 (B); Wallsburg May 21, 30, and June 4, 5 (B). *Davis County:* Farmington Bay area, May 23, and June 7, 9 (B).

Usual nesting sites include grassy pastures, recedes, or marginal lands.

Larus californicus Lawrence. California Gull. *Utah County:* Rock Island, Utah Lake, May 7 (26), 8 (18), 17 (20), 20 (8), 23 (6), 28 (11), 31 (4) (B). *Davis County:* promontory of Antelope Island, May 6 (3) (B).

Nesting in typical colonies on islands or promontories.

Larus pipixcan Wagler. Franklin's Gull. *Boxelder County:* Marsh area near Mouth of Bear River, May 6 (22), 17 (2) and 30 (B).

The nesting colony, in company with the white-faced glossy ibis, is situated over shallow water in a growth of bayonet grass marginal to open water of a small lake. Nests are of bayonet grass slightly depressed to hold the eggs.

Sterna forsteri Nuttall. Forster's Tern. *Utah County:* Rock Island, Utah Lake, May 28 (4) and June 4 (9), 9 (19) (B); North shore of Utah Lake, near Lehi, May 28 (2) (H). *Salt Lake County:* June 5 (6) (B). *Davis County:* Delta of Jordan River, June 5 (B).

Nests are slight depressions lined with varying amounts of weed stems. They may be placed either on the ground of island or on broken down mats of rushes over water.

Hydroprogne caspia imperator (Coues). Caspian Tern. *Utah County:* Rock Island, Utah Lake, May 5 (2), 7, 19, 23 (5), 28 (15), and June 4 (9), 9 (2), 6 (8) (B).

A colony nests in company with the California Gull on Rock Island.

Chlidonias nigra surinamensis (Gmelin). Black Tern. *Salt Lake County:* Black Slough area, June 8 (4) (B); Halloran Duck Club, June 8 (2) (H). *Boxelder County:* Chesapeake Lake, June 10 (2) (B). *Davis County:* Delta of Jordan River, June 10, 17 (B).

The usual nesting sites are on mats of dead rushes in marshes or on grass tufts of inundated marginal lands.

Zenaidura macroura marginella (Woodhouse). Western Mourning Dove. *Utah County:* Lehi vicinity, May 1, 10, 22, 24, 29 (2), June 1, 16, 18, 22, 23, July 12, 20, and August 4 (H); Provo, May 22 (Y). *Davis County:* Farmington Bay,

May 27 (3) (B). *Salt Lake County:* May 20, 28, and June 10 (B). *Kane County:* Willow Tank Spring, June 20 (Y).

Nests are slight platforms of twigs or rootlets on a limb of a tree or bush usually near the ground. They may also be placed on the ground.

Coccyzus americanus occidentalis Ridgway. California Cuckoo. *Utah County:* Provo River Bottoms, June 8 (B); Lehi, June 28 (H).

The nest found by Bee was a frail platform of twigs saddled on a broken down limb of a cottonwood tree a few feet from the ground. These birds inhabit the wooded areas of the river floodplains.

Otus asio inyoensis Grinnell. Inyo Screech Owl. *Utah County:* near Lakeshore, May 9 (B); West Canyon, May 23 (B); Lehi, April 5 (H).

The usual nesting site is in the cavity of a flicker hole in a tree. A few wood chips and stray feathers may be taken in the bottom of the nest.. Nesting holes are usually 15 to 20 feet from the ground.

Otus flammeolus (Kaup). Flammulated Screech Owl. *Utah County:* Mutual Dell, Mt. Timpanogos, June 13, 1934 (H).[6]

The nest was placed in a living aspen 12 feet from the ground. No nesting material was used but wings of small birds eaten by the owls were in the nest. The eggs were fresh on the above date.

Bubo virginianus occidentalis Stone.[7] Montana Horned Owl. *Utah County:* Vicinity of Lake Mountain, March 28, 19, April 5, 7, 17, 18, 19, and May 2 (young) (BH); Vicinity of Lehi, March 15, 24 (2), 19, and April 29, 7 (H); South Fork of Provo Canyon, March 21, and April 10 (YB); Cedar Valley, March 22 (H). *Wasatch County:* Vicinity of Charleston, March 26 (2), and April 6, 7, 26, 27 (B). *Salt Lake County:* Bingham Canyon, April 30 (B). *Millard County:* Kanosh, March 20 (B).

Nests are on bare earth, with occasionally a few feathers or sticks added, located on a shelf or niche of a cliff; or old hawk or other bulky nests of sticks may be used. This last mentioned type is often found in trees.

Spcotyto cunicularia hypugaea (Bonaparte). Western Burrowing Owl. *Utah County:* West of Lehi, April 30, May 1, and June 3 (H). *Salt Lake County:* near Welby, May 24 (B). *Boxelder County:* west of Brigham City, May 6 (B).

The nesting site is at the end of a burrow along a canal bank, wash or other terrain high enough to have a measure of protection from floods. Manure is usually carried in for nesting material.

Asio wilsonianus (Lesson). Long-eared Owl. *Utah County:* Lehi, April 7, 28 (H); Lake Mountain area, April 10, 25, and May 2 (HY), June 16 (H); west of Springville, April 18 (Y). *Salt Lake County:* Bingham Canyon, May 5 (2), 10, 24 (B); Lark, May 5 (B). *Tooele County:* Oquirrh Range, April 11 (B).

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(6) At the time this nest was discovered Mr. Hutchings collected the bird from the nest and prepared it as a mounted specimen. I have examined this specimen and find it to be undoubtedly the flammulated screech. The nesting of this species on Mt. Timpanogos under similar circumstances has been previously reported (Hayward, 1937. Wilson Bulletin, 49: p. 304).—C. L. H.

(7) A specimen taken from the nest in the South Fork, Provo Canyon, was identified by Dr. H. C. Oberholser as **occidentalis** (see Hayward, 1937, Wilson Bulletin, 49: p. 305). However, the subspecific identity of the nesting birds of the west desert and south is still somewhat in doubt, since no nesting specimens were available to the writers.—C. L. H.

Davis County: Farmington Bay area, May 4 (young in nest) (B). *Wasatch County:* Charleston, April 26 (B).

An old hawk or magpie nest is utilized as a nesting site.

Asio flammeus flammeus (Pontoppidan). Short-eared Owl. *Utah County:* Provo Bay area, April 19, 24, 25 (B); Lehi, May 9, 10 and June 16, 22 (HY). *Juab County:* Fish Springs, May 4 (B). *Davis County:* Farmington Bay area, April 25 (B).

The nests are depressions on the ground lined with sticks and weeds. They are usually placed in weed patches or rushes near marsh areas or on accretion ground.

Phalaenoptilus nuttalli nuttalli (Audubon). Nuttall's Poor-will. *Utah County:* South Fork of Hobble Creek Canyon, June 4 (B). The bird was flushed from the nest at close range; Granite Mountain near Alpine, May 23 (set of eggs acquired by R. G. Bee from Andrew Johnson of American Fork). *San Juan County:* Ute Mountain, June 23 (Y).

Chordeiles minor hesperis Grinnell. Pacific Nighthawk.[8] *Utah County:* West Canyon, Cedar Valley, July 2, 4 (3), 6 (2), 11, 24 (2) (HB); Hobble Creek Canyon, June 29 (H); Pelican Point, Utah Lake, July 22 (H). *Wasatch County:* Wallsburg Ridge, June 30, and July 4 (5), 5 (B); Strawberry River Dam, July 7 (3) (B).

Eggs are placed on bare ground usually at the base of a sage. The favorite nesting site is on a gradual slope near the top of a ridge.

Aeronautes saxatalis saxatalis (Woodhouse). White-throated Swift. *Grand County:* Arches National Monument, August 14, 1941. The birds were nesting in a cavaty formed by a slight separation of a slap of rock from the roof of a cave. Adults weer seen entering the aperture and young could be heard in the nest (B).

Archilochus alexanderi (Bourcier and Mulsant). Black-chinned Hummingbird. *Utah County:* near mouth of Alpine Canyon, June 11 (H).

Selasphorus platycercus platycercus (Swainson). Broad-tailed Hummingbird. *Utah County:* Provo River Bottoms, May 20 (B); Mt. Timpanogos, May 31, June 12 (2), 13, 24, and August 1 (HYB); Alpine, July 2 (H). *Salt Lake County:* Bingham Canyon, June 12, 13, and July 11 (B). *Summit County:* Upper Weber River, June 14 (3) and 19 (B).

The nest is a neat cup of plant down and (or) cottonwood "snow," decorated to simulate the environment with lichens or leaves bound with cobwebs. It may be placed on the limb of most any tree or shrub and often on a branch overhanging water.

Selasphorus rufus (Gmelin). Rufous Hummingbird.[9] *Utah County:* Lehi, June 20, 21 and July 30 (H).

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(8) Male nighthawks taken in the vicinity of Mt. Timpanogos during the nesting season have proved to be **hesperis** but no breeding females have been taken thus far. The subspecies **henryi** is known to breed eastward in the Uinta Basin (see Hayward, 1940, Great Basin Nat., 1 (2); p. 94).—C. L. H.

(9) The breeding records of the rufous hummingbird are of unusual interest. Bent (1940, U. S. Nat. Mus. Bull. 176, p. 396) states that the species breeds south as far as southwestern Montana and suggests that it may be found in the mountains further southward. A nesting specimen was collected and mounted by Mr. Hutchings and was later supposedly sent to the Brigham Young University, but unfortunately it was lost. However, Mr. Hutchings carefully checked the specimen and there is no doubt as to its identity.—C. L. H.

Nests were composed of cottonwood floss, lichens and bits of wood. They were placed on the limb of an apple tree 3.5 to 5 feet from the ground.

Colaptes cafer collaris Vigors. Red-shafted Flicker. *Utah County:* Mouth of Spring Creek, May 13 (B); Provo River, Utah Valley, May 2, 15 (B); Lehi, May 10, 22 (B); Mt. Timpanogos, May 17 and June 19 (B). *Wasatch County:* Provo River, May 21 (B).

The favored nesting site is a natural or self prepared cavity in a tree or post, in garrets of buildings, or occasionally in holes in earthen banks. Eggs are placed on chips at the bottom of the cavity or on a beam.

Asyndesmus lewis Gray. Lewis's Woodpecker. *Utah County:* Salamander Lake, Mt. Timpanogos, June 25 (B). *Salt Lake County:* Sugar House, July 7 (B).

Nests were placed in a shaft cavity averaging about 18 inches deep, usually high in partly dead trees.

Sphyrapicus varius nuchalis Baird. Red-naped Sapsucker. *Utah County:* Aspen Grove, Mt. Timpanogos, June 25 (young) (B); Vivian Park, Provo Canyon, July 5 (feeding young) (B).

Dryobates villosus monticola Anthony. Rocky Mountain Hairy Woodpecker. *Utah County:* Mule Flat, Mt. Timpanogos, May 17 (young) (B); Aspen Grove, Mt. Timpanogos, June 19 (young) (B).

Dryobates pubescens leucurus (Hartlaub). Batchelder's Woodpecker. *Utah County:* Summit of Loop Road, Mt. Timpanogos, July 11 (young in nest) (B).

Tyrannus tyrannus (Linnaeus). Eastern Kingbird. *Utah County:* Palmyra, June 18 (B); vicinity of Lehi, June 11, 20, 25, 26, 28, 29 (HB). *Davis County:* Farmington Bay, June 23 (B).

The nest is a cup of hay and weed stalks lined with varying amounts of hair and wool, and placed at an average height of about 12 feet in trees which usually have dead branches.

Tyrannus verticalis Say. Arkansas Kingbird. *Utah County:* Provo, June 10 (B); Spanish Fork, June 18 (B); Lehi, June 29 and July 1 (H); Saratoga Springs, June 16 (H). *Salt Lake County:* Hibbard, June 20, 22 (B); Ft. Harriman, June 16 (B); Welby, June 24 (B).

Sayornis saya saya (Bonaparte). Say's Phoebe. *Utah County:* Lake Mountain, May 13 and June 3 (B); Saratoga, May 23 (B); Cedar Valley, May 28, 23 (H); Rush Valley, July 8 (H); Pelican Point, Utah Lake, May 13 (H).

Nests are large scraggly masses composed of hay, string, rags, wool and feathers, placed on the beam of an outbuilding, old mine tunnel or the like.

Empidonax trailli brewsteri Oberholser. Little Flycatcher. *Utah County:* Lehi, May 16, 20, June 15, 28, 29 (2), 30 (3) and July 1 (BH); Provo, June 22 (3), 23 (B).

The favorite nesting habitat is in thickets of wild rose or willow near a stream or marsh. The nests are composed of fine plant fibers, weed bits and rootlets.

Empidonax oberholseri Phillips. Wright's Flycatcher.[10] *Wasatch County:* Keetley, June 14 (B).

The nest was composed of fine grasses and plant fibers and placed in the crotch of an oak near a spring. This nest also contained hair, wool, and feathers.

Empidonax difficilis difficilis Baird. Western Flycatcher. *Utah County:* Aspen Grove, Mt. Timpanogos, June 26 (2) (Y); American Fork Canyon, June 26 and July 24 (H).

Nesting sites are usually cool shaded places close to water or on cliffs with water dripping near the nest. The nest is composed of fine rootlets and grasses with growing moss over the surface.

Myiochanes richardsoni richardsoni (Swainson). Western Wood Pewee. *Davis County:* Layton, June 10 (B). *Utah County:* Mt. Timpanogos, June 19 (nest under construction), July 10, and August 12 (young) (Y).

The nests are neat cups of fine plant fibers and hair usually placed on a horizontal, dead limb of an aspen or poplar.

Otocoris alpestris utahensis Behle. Great Salt Lake Horned Lark. *Utah County:* Cedar Valley, April 25, May 30, and July 1 (H). *Salt Lake County:* Bingham Canyon, May 12 (B); Copperton, April 12 and June 24 (B); pasture near Black Sloughs, May 9 (B); between Ft. Harriman and Lark, April 11 (B).

Nesting sites are usually in short grass arid or semi-arid situations. The nests are cupped in the ground and composed of grass, hay and plant down, occasionally with a sparse amount of wool added.

Tachycineta thalassina lepida Mearns. Violet-green Swallow. *Utah County:* Salamander Lake, Mt. Timpanogos, June 25 and July 5 (3), 6 (B); American Fork Canyon, June 21 (B) and July 8 (H); Mt. Timpanogos, June 21 and July 25 (H).

This species usually nests in small colonies often in company with tree swallows and purple martins. The nests are a few feathers or inner bark fibers placed in the bottom of cavities in dead or living aspens.

Iridoprocne bicolor (Vieillot). Tree Swallow. *Utah County:* Salamander Lake, Mt. Timpanogos, June 25 (B); Silver Lake, American Fork Canyon, June 23 and July 4 (H). *Sevier County:* Fish Lake, July 18 (seen at nesting hole) (B).

The nesting habits are similar to those of the violet-green swallow.

Riparia riparia riparia (Linnaeus). Bank Swallow. *Utah County:* Bank of Jordan River, June 19 (B).

Stelgidopteryx ruficollis serripennis (Audubon). Rough-winged Swallow. *Utah County:* Lehi, June 2, 12, 15. The nest was placed in a recess of a thatched roof of a cow shed (H).

Hirundo erythrogaster Boddaert. Barn Swallow. *Utah County:* Jordan River near Lehi, June 28 (2) (B). *Salt Lake County:* Draper, May 23, 31 (2) and July 2 (2) (B).

This species nests in colonies in outbuildings. The nests are masses of mud

(10) Notes pertaining to the nesting of Wright's flycatcher, together with 19 other species of mountain dwelling birds have been reported by Hayward, Great Basin Nat. 2 (1); pp. 1-8, pl. I, 1941. Photographs of nests and eggs of 7 species are shown.—C. L. H.

pellets cemented into a cup-shaped structure and lined with feathers of varying amounts.

Petrochelidon albifrons albifrons (Rafinesque). Northern Cliff Swallow. *Utah County:* Diamond Fork, Spanish Fork Canyon, June 12 (8) (B). *Wasatch County:* Indian Canyon, July 13 (3) (B).

Progne subis subis (Linnaeus). Purple Martin. *Utah County:* Mt. Timpanogos, June 25 (H).

This species is known to nest only in the mountains, in central Utah. It is found in aspen forests and usually selects large dead aspens or rarely the dead tops of solitary conifers as nesting sites.

Cyanocitta stelleri annectens (Baird).[11] Black-headed Jay. *Utah County:* Alpine Canyon, May 30 and June 3 (B).

The nests were placed in conifers 7 to 14 feet above ground. They were bowl shaped structures in a mass of twigs composed of moss and dry grass cemented with mud and lined with rootlets.

Aphelocoma californica woodhousei (Baird). Woodhouse's Jay. *Utah County:* North end of Cedar Valley, May 25 (young) (B); Mouth of Alpine Canyon, May 25 (H); Tickville, west of Lehi, April 22 and May 10, 20 (H). *Salt Lake County:* Butterfield Canyon, April 25 (B); west of Lark, June 11 (B).

The outer shell of the nest is composed of sticks while the inner bowl is made of cedar bark strips, rootlets, and horsehair. They are placed in a juniper or oak 5-10 feet up from the ground.

Pica pica hudsonia (Sabine). American Magpie. *Utah County:* mouth of Hobble Creek, May 1 (2), April 8, 15, 16 (B); Springville, April 3 (B); Cedar Valley, April 4 (H); Lehi, March 30, April 10, 20, May 10, and July 3 (H). *Wasatch County:* Wallsburg bridge, Provo River, April 25 (B); Charleston, Provo River, April 16 (B). *Salt Lake County:* Dry Fork of Bingham Canyon, May 5, 24 (B).

Corvus corax sinuatus Wagler. American Raven. *Utah County:* Lake Mountain, March 28, 31, April 3, 17, 18 and May 7 (HB); Cedar Valley, April 14, 15, 25, 28 (2), and March 30 (HB); Sunshine Canyon, May 4 (H); west side of Utah Valley, March 21 (H). *Tooele County:* Rush Valley-Cedar Valley Divide, April 8 (B); Rush Valley, April 7, 14 (H); Orr's Ranch, May 3 (B); Desert Mountain, April 19 (H); Skull Valley, April 26 (H). *Iron County:* seven miles SW of Kanosh, March 21 (B). *Millard County:* Fish Springs, April 30 (H); vicinity of Kanosh, March 20 (4); Delta, April 16 (H).

This species constructs a well cupped nest with the outer part of juniper and sage sticks and a tight inner cup of sage and juniper bark. When available, wool and hair are also used in the lining. Nests are placed on a shelf of a cliff, on timbers of mine hoists and deserted buildings, and in cottonwood or juniper trees.

Corvus brachyrhynchos hesperis Ridgway. Western Crow. *Utah County:* mouth of Hobble Creek, west of Springville, May 5 (a set of four eggs is in

(11) Dr. William H. Behle who has critically examined our Cyanocitta states in a letter that he is unable to recognize the subspecies **cottami** recently described by Oberholser (1937, Proc. Biol. Soc. Wash., 50: p. 117). He further indicates that the northern and central Utah birds more nearly resemble **annectens**.—C. L. H.

the Y collection, collected by C. L. Hayward and D. E. Johnson). *Wasatch County:* near Wallsburg Bridge, Provo River, April 26 and May 10 (B).

Nests are well made of sticks and compactly lined with inner bark of the cottonwood and horsehair. The nests observed were placed in black willows 14 to 22 feet from the ground.

Cyanocephalus cyanocephalus (Wied). Pinon Jay. *Utah County:* Five Mile Pass, March 30, 31 and April 8 (B); Lake Mountain, April 1, 2 (5), 9 (4) (HB); Cedar Valley, April 13 (H); east of Sunshine, May 10 (H); Tickville, west of Lehi, May 14, 20 (2) (H).

This species nests in colonies in juniper trees at an average height of six feet. The nests are deep and bulky, compactly built of twigs and shreds of inner bark supporting a well made cup of various shreds of bark, plant fibers, rootlets, weeds, wool, grasses and an occasional feather.

Nucifraga columbiana (Wilson). Clark's Nutcracker. *Utah County:* One nesting record only is available to the writers. The nest was located March 30, 1941 on the south side of Slide Canyon, Wasatch Range, east of Provo at about 7,000 feet altitude by James W. Bee. The nest was constructed and contained one egg on that date. Because of illness James was unable to revisit the nesting site, but his father, R. G. Bee and Reed Biddulph, photographer, visited it again on April 7. On this last visit photographs were taken and the set of three eggs was collected.

The outer nest was of conifer and mahogany sticks while the inner cup was a compact structure of plant fibers, hay, inner bark, pulpy wood strips and a few conifer needles in the bottom. It was placed on two branches of a white fir tree near the main trunk and was about 8 feet above approximately 4 feet of snow. The tree in which the nest was placed measured 4 inches in diameter at the level of the nest.

Penthestes atricapillus septentrionalis (Harris). Long-tailed Chickadee. *Utah County:* Lehi, May 25 (B); Aspen Grove, Mt. Timpanogos, June 27 (2) (B); American Fork Canyon, July 6 (H).

The nesting site is in the cavity of an old tree stump or tree or under the eaves of a house. The nest lining consists of fine grasses and feathers.

Penthestes gambeli gambeli (Ridgway). Mountain Chickadee. *Utah County:* Salamander Lake, Mt. Timpanogos, June 25 (B); *Wasatch County:* ten miles east of Kamas, June 26 (B). *Salt Lake County:* Butterfield Canyon, June 4 (B).

Psaltriparus minimus plumbeus (Baird). Lead-colored Bush-Tit. *Utah County:* Cedar Valley, June 10, 1933 (H).

The nest was a pensile structure, entered from the side and composed of hay and plant fibers and lined with wool and feathers. It was placed 12 feet up in the top of a juniper.

Certhia familiaris montana Ridgway. Rocky Mountain Creeper. *Utah County:* Cirque above Granite Flat, American Fork Canyon, June 15, 1936 (H).

This nest was placed in a conifer about 6 feet up behind a piece of loose bark.

Sitta carolinensis nelsoni Mearns. Rocky Mountain Nuthatch. *Utah County:* above Granite Flat, American Fork Canyon, June 18 (H).

The nesting site of the above record was in an abandoned woodpecker hole, 30 feet up in the side of a tree. Five eggs were in the set.

Cinclus mexicanus unicolor Bonaparte. Dipper. *Utah County:* Springdell, April 27 (B); North Fork, Provo Canyon, May 17 (B).

Nests are oven-shaped structures composed of moss and lined with fine grass. The entrance is at the side. The nest may be placed in a niche of a cliff among the roots of a tree or on the beam of a bridge always close to the edge of a stream.

Troglodytes aedon parkmani Audubon. Western House Wren. *Utah County:* Maple Flat, east of Provo, June 22 (B); Salamander Lake, Mt. Timpanogos, June 21, 25, 29 (BY); Lehi, May 29 (H); American Fork Canyon, June 2 (H); Aspen Grove, Mt. Timpanogos, June 29 (H); Silver Lake, American Fork Canyon, July 8 (H). *Salt Lake County:* Bingham Canyon, June 17 (B). *Wasatch County:* Strawberry Valley, June 6 (B).

Nests are of twigs, hay and grasses lined with hair, fur and feathers, placed in a crevice of a barn, house, post or tree.

Telmatodytes palustris plesius (Oberholser). Western Marsh Wren. *Utah County:* Provo Bay, April 29 (2), May 10, 17, June 8 (B); Utah Lake, April 22 (B); Lehi, April 29, May 10 (2), 22, 28, 30 (2), and June 16 (H).

Catherpes mexicanus conspersus Ridgway. Canon Wren. *Summit County:* Washington Lake, Uinta Mountains, July 7 (B).

The nest was a mass of soft materials placed in a niche of rock bordering a stream.

Salpinctes obsoletus obsoletus (Say). Common Rock Wren. *Utah County:* Oquirrh Range, May 26 (B); 7-mile Pass, west of Lehi, June 6 (B); east side of Lake Mountain, April 21 (B); Pelican Point, Utah Lake, May 26, 29 (H). *Washington County:* St. George, April 29 (Y).

Nests are built at the end of a tunnel under a boulder or niche of ledge and are placed in a depression lined with hay and grass.

Mimus polyglottos leucopterus (Vigors). Western Mockingbird.(12) *Utah County:* West of Lehi, May 30, June 3, 4 (2), 10, 13 (2), 20, 21, 24, 28, and July 2 (HB).

Greasewood bushes are used as nesting sites. The nests are composed of sticks, lined with rootlets, grasses and wool.

Dumetella carolinensis (Linnaeus). Catbird. *Utah County:* Provo River Floodplane, west of Provo, June 4, 10 (2) (B); Lehi, May 1, and June 30 (H). *Wasatch County:* Wallsburg Switch, June 11 (B).

This species makes bulky and rudely constructed nests of twigs, leaves and grasses and lined with fine grasses. They are placed in a thicket near a stream.

Toxostoma bendirei (Coues). Bendire's Thrasher. *Utah County:* Lake shore south of Lehi, April 26, 1932 (H).

The nest was composed of small sticks lined very neatly with fine grass, rootlets and horse hair. It was placed on the stump of a black willow and was

(12) Nesting and distribution of the western mocking bird in Utah have been described by Vasco M. Tanner, Proc. Utah Acad. Sciences, Arts, and Letters, 13: pp. 185-187, one map, 1936.—C. L. H.

cleverly hidden by a new growth of willow. The eggs of this species are spotted with brown, light drab, and lilac gray especially at the large end in contrast to those of the Leconte thrasher which are minutely speckled and the Crissal thrasher which has eggs that are plain pale bluish green. The egg characteristics together with the appearance of the bird make this record quite certain although it is rather far removed from its normal range.

Oreoscoptes montanus (Townsend). Sage Thrasher. *Utah County:* vicinity of Lehi, April 26, May 8, June 4, 6, 10 (4), 13, 16, 22, 27 (3), and July 1, 3 (3), 4, 10, 19 (HB). *Salt Lake County:* Copperton, May 27; Bingham, May 6 (B); Black Slough Area, May 5 (2) (B).

Nests are of sage sticks, lined with bark strips, fine rootlets and sometimes cattle hair. They are placed in a sage or greasewood.

Turdus migratorius propinquus Ridgway. Western Robin. *Utah County:* Provo, May 8, 18 (B); Lehi, April 4, 20, May 10, June 1, 28 (H). *Salt Lake County:* West Jordan, May 29 (B).

Nests are of hay, sticks and leaves with a plastered cup of mud and placed in trees, bushes or buildings.

Hylocichla guttata auduboni (Baird). Audubon's Hermit Thrush. *Utah County:* South Fork of Provo Canyon, June 7 (B); Stewart's Flat, Mt. Timpanogos, June 25 (B); American Fork Canyon, June 12, 25, 29 (2), and July 2 (H). *Salt Lake County:* Dry Fork of Bingham Canyon, June 5 (B); Barney's Canyon, June 4 (B); Butterfield Canyon, June 4 (5), 11 (B).

This species builds a nest of sticks, bark, rootlets, moss, leaves and horsehair woven into a bowl-shaped mass, placed in a bush or tree at medium or low levels. Nesting sites are often near streams. The species is distributed throughout the montane forests and extends somewhat into the chaparral ecotone.

Hylocichla ustulata swainsoni (Tschudi). Olive-backed Thrush. *Utah County:* South Fork of Provo Canyon, June 20 and July 5 (B); American Fork Canyon, June 22, 24, and July 6, 24, 26 (H).

Nests are placed at low levels in a bush or tree and are composed of hay and leaves with a small amount of horsehair. This species breeds mainly in canyon bottoms near water and is distributed mostly within the chaparral ecotone and lower montane forests.

Hylocichla fuscescens salicicola Ridgway. Willow Thrush. *Utah County:* Provo River floodplain NW of Provo, June 4 (2), 29 (B); American Fork Canyon, July 4 (2), 24 (H).

This species inhabits thickets and woods along the river floodplains in valleys, chaparral and lower montane forests. Nests are composed of twigs, hay, grass and bark strips and are placed in clumps of bushes near the stream.

Sialia currucoides (Bechstein). Mountain Bluebird. *Utah County:* Mt. Timpanogos Cirque, June 28 (Y); Lehi, July 2, 3 (H); Cedar Valley, May 16 (2) (H). *Salt Lake County:* Lark, May 2 (B). *Wasatch County:* Keetley, June 13 (B).

The nest is a sprawly structure composed of hay, feathers, and bark strips placed in cavities of a tree, house, outbuilding or on mine timbers.

Myadestes townsendi (Audubon). Townsend's Solitaire. *Utah County:*

Stewart's Flat, Mt. Timpanogos (no date) (B). *Garfield County:* Birch Creek Canyon, west of Escalante, June 15 (Y).

Nests are large loosely woven piles of plant material placed in a rock crevice or among exposed roots of a bank.

Polioptila caerulea amoenissima Grinnell. Western Gnatcatcher. *Utah County:* Tickville, Cedar Valley, June 20 (eggs). July 4 (young) (H).

The nest was of plant fiber and down, lined with plant down and hair. The outside was decorated with lichens to simulate the limb of a juniper on which it was placed.

Corthylio calendula cineraceus (Grinnell). Western Ruby-crowned Kinglet. *Wasatch County:* Lost Lake area, Uinta Mountains, June 22 (nest found by J. L. Mullins) (B).

Anthus spinoletta alticola Todd. Mountain Pipit. *Summit County:* Lily Lake, Uinta Mountain, June 26 (B). *Sevier County:* 7 mile Creek near Fish Lake, June 16 (B).

The nest is a globular or cup-shaped structure of hay lined with horsehair. It is placed on a slight raise in boggy, grassy meadows in alpine or upper montane forest areas.

Bombycilla cedrorum Vieillot. Cedar Waxwing. *Utah County:* Lehi, July 1 (H).

The nest was placed on a limb of a black willow and was composed of rags, twine, twigs, and cedarbark.

Lanius ludovicianus nevadensis Miller. Nevada Shrike. *Utah County:* April 28, May 18, July 6 (H); west of Lehi, May 25, June 20 (H); south end of Utah Valley, April 25 (H); Lake Mountains, May 17. *Salt Lake County:* six miles NW of Salt Lake City, April 7 (B).

Nests are composed of twigs, hay, wool and hair, well cupped and at times decorated with bones or skin. They areu sually placed in an isolated greasewood or juniper.

Vireo solitarius plumbeus Coues. Plumbeous Vireo. *Utah County:* Provo River floodplain, northwest of Provo, May 18 (collected by D. E. Johnson and C. L. Hayward).

This nest was composed of fine plant fibers together with cobwebs and covered with lichens. It was situated in a cottonwood tree about 20 feet from the ground.

Vireo gilvus swainsoni Baird. Western Warbling Vireo. *Davis County:* A set of eggs was collected by Harry Aldous from a nest situated 10 feet up in an apple tree. The exact location and date are not given (B).

Vermivora celata orestera Oberholser. Mountain Orange-crowned Warbler. *Wasatch County:* Strawberry Valley, June 11 (H).

This nest was placed 8 feet up in a willow near a stream. It was composed of grasses, dry leaves, bark shreds and feathers. The bird was collected for positive identification.

Vermivora virginiae (Baird). Virginia's Warbler. *Utah County:* Hobble Creek Canyon, May 31 (B).

The nest was partially hidden by grass and placed on the ground among the roots of scrub oak on a hillside about 100 feet from the creek and canyon bottom. It was composed of plant fibers, rootlets and hay, loosely woven.

Dendroica aestiva morcomi Coale. Western Yellow Warbler. *Utah County:* Provo River floodplain, west of Provo, May 30, and June 4, (B); South Fork of Provo Canyon, June 26 (B); Provo, June 4 (B); Alpine Canyon, June 15 (3) (H); Lehi, June 5, 11, 15 (3), 21, 24 (H). *Wasatch County:* Strawberry Valley, June 11 (H).

This species constructs a nest of plant fibers and grasses lined with plant down and horsehair, placed at moderately low levels in a bush or tree, usually near a stream.

Dendroica audubani memorabilis Oberholser. Rocky Mountain Audubon Warbler. *Utah County:* American Fork Canyon, June 18, 28 (H). *Wasatch County:* Beaver Creek Ranger Station, May 29 (nest under construction) (Y). *Salt Lake County:* Bingham Canyon, June 17 (B).

This species builds a nest of fine bark strips, rootlets, plant fibers, hair and a few feathers, placed in a bush or tree. These birds breed throughout the montane forests.

Dendroica nigrescens (Townsend). Black-throated Gray Warbler. *Utah County:* Tickville, 12 miles west of Lehi, May 20, 1940 (H).

The nest was composed of plant fibers, juniper bark, fine dry grass and a few feathers and was completely concealed in the forks of a juniper near the top.

Oporornis tolmiei (Townsend). Macgillivray's Warbler. *Utah County:* Vivian Park, Provo Canyon, June 25 (young just hatched), July 4, 5 (feeding young) (B), June 21 (H). (Also egg record).

Nests were of shreds of bark lined with fine grasses and hair. They are usually placed low in shrubs at the forest edge in canyons.

Geothlypis trichas occidentalis Brewster. Western Yellow-throat. *Utah County:* Lehi vicinity, April 16, May 20, 28, 29, 31 and June 6 (2), 13 (HB).

Usual nesting sites are marshy areas, often in wet borrow pit along a road or railway right of way. Nests are made of dry grass or rushes attached to a last year's cattail.

Icteria virens longicauda Lawrence. Long-tailed Chat. *Utah County:* Provo vicinity, June 3, 5, 29 (B); Lehi vicinity, June 20, 21, 28, 30 (HB).

Nests are composed of bark, rootlets, and dry leaves lined with finer grasses and placed in a bush, hedgerow or thicket along a stream, fence or base of a low hill.

Setophaga ruticilla (Linnaeus). American Redstart. *Utah County:* Provo River floodplain, northwest of Provo, June 10, 26 (newly hatched young) (B).

The nests of this species are firmly woven of fine bark strips, leaf stalks and plant down, lined with fine grass and horsehair. They are usually placed about 5 feet up in a cottonwood bordering the stream.

Dolichonyx oryzivorus (Linnaeus). Bobolink. *Utah County:* Saratoga, June 19 (B). *Wasatch County:* Charleston, June 15 (B).

This species builds a nest of hay placed on the ground among grasses of pasture or accretion ground.

Sturnella neglecta Audubon. Western Meadowlark. *Utah County:* Provo Bay area, April 16, May 7 (2) (YB); Lehi vicinity, April 17, 29 (B).

The nest is of dry grasses hooded over with the same and placed on the ground of pasture or field.

Xanthocephalus xanthocephalus (Bonaparte).[13] Yellow-headed Blackbird. *Utah County:* Mouth of Provo River, May 27 (4) (Y); Lehi vicinity, May 1, 10, 17, 25, 27 (H).

The yellow-headed blackbird builds a well-cupped nest of dry marsh grass attached to rushes over slough or marsh.

Agelaius phoeniceus utahensis Bishop. Utah Redwing. *Utah County:* NW of Provo, May 17 and June 1 (B); Geneva, near Utah Lake, May 21 (2) and 25 (B); mouth of Dry Creek, May 10 (2) (B); vicinity of Lehi, May 10 (7), 15, 20, 23, 25, and June 3, 10, 12, 21, 23, 28 (H). *Wasatch County:* Wallsburg, May 21and June 5 (B). *Davis County:* Farmington Bay Area, May 2, 8, 10 (B).

This species nests in pastures or in tules of a mash or slough. The nest is a well-shaped bowl of hay lined with cattle hair.

Icterus bullocki (Swainson). Bullock's Oriole. *Utah County:* south of Provo, May 31 (B); Palmyra, June 5 (B); Lehi, June 1, 13, 26 (H). *Salt Lake County:* South Jordan, May 27 and June 20 (B).

The nest is a pensile structure of plant shreds and string, lined with plant down and horsehair and attached to the outer limb of a tree. Nesting areas include roadsides, pastures or fields.

Euphagus cyanocephalus (Wagler). Brewer's Blackbird. *Utah County:* Provo Bench, May 17 and June 8 (B); Geneva, May 18 (4), 26 (B); Provo River bottoms, May 27 (3) (B); Lehi vicinity, May 20 (5), 23, 24, 27, 30 and June 6 (2), 10 (H). *Salt Lake County:* Hibbard, June 3 (B); Riverton, June 2 (B). *Wasatch County:* Wallsburg switch, May 28 (B). *Davis County:* Farmington Bay area, May 27 (B).

The nest is of hay and weed stems with horsehair in the cup. It may be placed in grasses of pastures or in bushes or trees.

Molothrus ater artemisiae Grinnell. Nevada Cowbird. *Utah County:* Utah Lake, June 30 (in nest of redwing blackbird) (B); Lehi, June 5 (in nest of black-headed grosbeak) (H). *Salt Lake County:* Riverton, June 2 in nest of Brewer's blackbird) (B).

Piranga ludoviciana (Wilson). Western Tanager. *Utah County:* Mule Flat, Mt. Timpanogos, June 2 (2), 27 (HBY); Stewart's Flat, Mt. Timpanogos, June 23 (B); Aspen Grove, Mt. Timpanogos, June 15 (Y).

The nest is a frail structure of weed stems and rootlets placed on the horizontal limb of a tree or bush, in either deciduous or coniferous woods of the lower montane forests.

Hedymeles melanocephalus papago Oberholser. Rocky Mountain Black-headed

(13) The breeding habits of this species in Utah have been extensively described by Fautin, 1940, Great Basin Nat., 1 (2): pp. 75-91; 1941, Wilson Bulletin, 53 (2): pp. 107-22; 1941, Auk, 58: pp. 216-232.

Grosbeak. *Utah County:* Spanish Fork, May 27 (B); Provo vicinity, June 4 (2), 10, 22 (2) (YB); Mt. Timpanogos, June 19 and July 11 (eggs deserted and cold) (Y); Lehi, May 1, 10 (2), 16, 21, 26, 31, and June 3 (H). *Salt Lake County:* Hyland Bay, May 27 (B). *Wasatch County:* Beaver Creek Ranger Station, June 26 (B).

This species builds a flimsy nest of weed stems, rootlets, and twigs, placed in a tree or bush at moderately low levels. Eggs may often be seen through the bottom of the nest.

Passerina amoena (Say). Lazuli Bunting. *Utah County:* Mouth of Provo Canyon, June 3 (B); Provo, June 22, 4 (B); Vivian Park, Provo Canyon, July 2 (B); Lehi, May 25 (H). *Salt Lake County:* mouth of Barney's Canyon, June 4 (B).

Nests are composed of plant fibers, twigs, hay and leaves placed at low levels in bushes such as wild rose, willow, or wild currant.

Hesperiphona vespertina brooksi Grinnell.[14] Western Evening Grosbeak. *Utah County:* Salem, May 27, 1936. A set of 3 fresh eggs was presented to Mr. Hutchings by G. I. Bone.

The nest was situated in an oak 12 feet from the ground. It was loosely, but very well constructed and composed of fine twigs, rootlets and asparagus fern.

Carpodacus mexicanus ssp. House Finch. *Utah County:* Lehi, May 23 and June 1 (H). *Salt Lake County:* West Jordan, May 24, 28 and June 11 (B).

The house finch builds a compactly woven nest of dry grasses and bark shreds, lined with horsehair and sometimes wool, usually placed at low levels in trees.

Leucosticte atrata Ridgway. Black Rosy Finch. A single record is available of young in the nest, Burrow Mountain, Uinta Mountains, July 7, reported by G. C. Earl of Salt Lake City (B).

Spinus pinus pinus (Wilson). Northern Pine Siskin. *Utah County:* Lehi, April 1, 25, and May 5, 13 (HB).

This species builds a frail nest of dry grasses and rootlets lined with hair and a few conifer needles. It is usually placed rather low on the branches of a conifer.

Spinus tristis pallidus Mearns. Pale Goldfinch. *Utah County:* Saratoga Resort, Utah Lake, July 4 (H).

The above nest was placed in a boxelder about 3 feet from the ground. It was constructed of bark strips, compactly put together and lined with horsehair. It was completely hidden from view until the leaves were parted to expose it.

Oberholseria chlorura (Audubon). Green-tailed Towhee. *Utah County:* Y Mountain near rim of Rock Canyon, May 25 (B); Hobble Creek Canyon, May 31 and June 5 (B); Aspen Grove, Mt. Timpanogos, June 3 (Y); Tickville, west of Lehi, May 27 (H). *Wasatch County:* Wallsburg Ridge, July 13 (B); Straw-

(14) Mr. Hutchings informs me that Mr. Bone wso collected this record is well acquainted with the western evening grosbeak and there can be little doubt as to its identity. On July 24, 1937 Mr. James Bee and I saw western evening grosbeaks feeding young out of the nests at Elk Park, Uinta Mountains, Daggett County. I also collected one bird and saw a number of others in the La Sal Mountains, San Juan County, July 26, 1934. It seems likely that thees birds had bred in the area.—C. L. H.

berry Valley, May 30 (B); Bear Canyon, south of Provo Canyon, July 15 (H). *Salt Lake County:* Bingham Canyon, May 28 (B).

The nest is composed of twigs, bark, and leaves, lined with dry grass and horsehair. It is placed on or near the ground and is well concealed in brushy places.

Pipilo maculatus montanus Swarth. Spurred Towhee. *Utah County:* Cedar Valley, May 25 (B); Lehi vicinity, May 20 (2) and June 1, 10 (H); Provo River, west of Provo, June 26 (B). *Davis County:* Muehler Park, June 4 (B).

The nest is of leaves and strips of bark cupped in the ground and lined with hay. It is usually well hidden under a bush.

Passerculus sandwichensis nevadensis Grinnell. Nevada Savanah Sparrow. *Utah County:* Lehi vicinity, June 7, 30 (H). *Davis County:* Farmington Bay, May 23 and June 29 (B).

This sparrow builds a nest of hay in a tuft of grass in wet pasture areas.

Chondestes grammacus strigatus Swainson. Western Lark Sparrow. *Utah County:* Provo, June 1, 5 (B); Cedar Valley, June 26 (H); Lehi, May 26, 30, June 2, 4, 10, 26, and July 1, 9 (H).

The nest, composed of hay, plant stems and horsehair is placed on the ground among a growth of plants or under a bush.

Junco caniceps caniceps Woodhouse. Gray-headed Junco. *Utah County:* Salamander Lake, Mt. Timpanogos, June 25 (B); Vivian Park, Provo Canyon, July 5 (feeding young) (B); Hobble Creek Canyon, May 31 (young in nest); American Fork Canyon, June 25 and July 4 (H). *Garfield County:* Aquarius Plateau, June 26 (Y).

The junco constructs a frail nest of rootlets and grass in depressions in the ground. The nest is usually so situated under vegetation or bank as to receive some protection.

Spizella passerina arizonae Coues. Western Chipping Sparrow. *Utah County:* Hobble Creek Canyon, June 5, 18 (B); Lehi, May 10, and July 1, (2), 4 (H). *Salt Lake County:* Midvale, June 10 (B).

Nests are composed of grass, rootlets and plant fibers lined with horsehair. They are placed at moderate heights in bushes or trees, usually protected by an overhanging branch.

Spizella breweri breweri Cassin. Brewer's Sparrow. *Utah County:* Jordan River near Lehi, May 30 (B); Cedar Valley, May 4 (3) and June 14 (H). *Wasatch County:* Charleston, July 4 (B); Strawberry Valley, May 30 (3); Wallsburg, July 1 (B); mouth of Bear Canyon off Provo Canyon, June 5 (B).

This species constructs a nest of weeds, grass stems and plant fibers, lined with cattle hair and wool, and usually placed in a sage or other low bush.

Zonotrichia leucophrys leucophrys (Forster). White-crowned Sparrow. *Utah County:* Alpine Canyon, June 15 (2) (H). *Wasatch County:* Strawberry Valley, June 6 (B). *Summit County:* Trial Lake, June 26 (H).

The nest of fine grasses is placed in the ground or low in vegetation.

Passerella iliaca schistacea Baird. Slate-colored Fox Sparrow. *Utah County:*

Alpine Canyon, June 15 (2) (H). *Wasatch County:* Provo River, Wallsburg Switch, May 19 (B); Bear Canyon, off Provo Canyon, June 5 (B).

The outer shell of the nest is composed of bark strips and it is lined with bark shreds, grasses and horsehair. It is usually placed under a bank or at low levels in bushes.

Melospiza lincolni alticola Miller. Mountain Lincoln Sparrow. *Summit County:* Diamond Lake, Uinta Mountains, June 28, 1942 (collected by C. L. Hayward). The nest was on the ground in a clump of Vaccinium, near a small stream and within about 12 inches of a used beaver runway. It was composed of fine grasses and sedges. There were 5 fresh eggs in the set.

Melospiza melodia fallax (Baird). Mountain Song Sparrow. *Wasatch County:* Charleston, June 15, 24 (B). *Utah County:* Mouth of Provo River, May 3, 10 (Y).

The nest is of bark and grasses lined with horsehair or feathers, placed on or near the ground at the edge of a field or thicket.

SUMMARY

1. Breeding records of Utah birds based on about 17 years of field experience, mainly in Utah County, are included in the report. Many of the records represent sets of eggs collected. Where identification was in doubt, bird specimens were collected in certain instances.

2. A terse summary of nest construction and location is given following most of the species.

3. Trinomials, based on the best available information regarding the subspecific identity of breeding birds of the locality, are used. The fourth addition of the A. O. U. Check List is followed in general, with a few alterations concomitant with more recent work.

4. Nesting records of 150 kinds of birds are given. Data pertaining to the shore birds and hawks are especially abundant since the writers have spent most of their time working with these groups.

5. Among the more interesting breeding records are those of the ruffed grouse, dusky grouse, sandhill crane, flammulated screech owl, rufous hummingbird, Clark's nutcracker, Rocky Mountain creeper, lead-colored bush-tit, Bendire's thrasher, western gnatcatcher, western evening grosbeak, and turkey vulture.

JOHN HUTCHINGS AND ROBERT G. BEE -- PIONEER UTAH VALLEY NATURALISTS[1]

C. LYNN HAYWARD
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Brigham Young University

It has often been the case in the annals of natural history that many of the greatest contributions to our fund of scientific knowledge have come from the works of amateurs who have pursued these interests purely from taste rather than professionally. This has been particularly true in the fields of ornithology, entomology, botany, conchology, and mineralogy where the beauties of design, color and form of the several objects of natural history have ever been appealing to the esthetic aspect of the mind and have laid bare the pathway toward the uncovering of the more prosaic scientific facts. All true naturalists are artists at heart, and unfortunately their tastes have often carried them no further than the collection and arrangement of their material into trays and cabinets where their beauties may be seen and appreciated; but others have been more painstaking and assiduous in recording the dull statistics that are so vital to the fine analysis of scientific principles.

The ornithological work of John Hutchings and Robert G. Bee in central Utah aptly illustrates a lifetime of devotion to a delightful hobby combined with a conscientious endeavor to place their findings at the disposal of students who may follow them.

JOHN HUTCHINGS (1889——

John Hutchings, son of Mary Wanlass and William Lawrence Hutchings was born at Lehi, Utah County, Utah, March 11, 1889. He was educated in the public schools of Lehi and spent one quarter during 1909 at Brigham Young University.

From his early childhood he was an ardent collector of natural objects of beauty. When he was very young, the couch in the front room of his parents' home was a depository for a collection of pretty rocks gathered from a nearby stream as well as Indian relics found

(1) Contribution No. 104, Department of Zoology and Entomology, Brigham Young University, Provo, Utah.

about his father's farm. It so happened that this farm had been an Indian camp ground, and John spent many of his leisure hours in search of arrow heads and other items of archeological interest.

His interest in birds also began during his childhood and he states that as far back as he can remember he tried to mount bird specimens using hay leaves as stuffing. During the period of his young manhood Mr. Hutchings became trained in the art of taxidermy and has become extremely proficient in that field. Among his works in this field are groups of Brewster's egret, mallard, white-faced glossy ibis, kingfisher, ferruginous rough-legged hawk, and horned owl in their natural settings now on display at Brigham Young University. In addition there are individual mounts of the wood ibis, little brown crane and a number of others in the mounted bird collection at the University.

In his early days of egg collecting, Mr. Hutchings took only a single egg from each nest, not wishing to disturb the activities of the birds more than necessary. It was during this period, however, that he learned much about the identity and habits of the birds of his locality, a feature that helped him greatly in his future work. Mr. Hutchings credits Robert G. Bee of Provo with starting him out in his scientific collection of bird eggs and nesting records. His collection now consists of several hundreds of specimens consisting of complete clutches of eggs, nests and nesting material. The materials are well preserved, and the data cataloged on filing cards. Whenever necessary to establish identity a specimen of the nesting bird was also collected and preserved.

Being well known as a taxidermist and naturalist many specimens of rare and unusual birds were brought to him for identification and these were usually preserved as mounted specimens.

On September 17, 1913 he was married to Eunice Colledge, and since that time the two have worked together in all of the collecting activities. In addition to their work with the birds they have made extensive excavations and collections in Indian mounds of Utah County and have amassed a large collection of minerals.

This interest in a variety of fields keeps Mr. and Mrs. Hutchings busy in their spare time throughout the year. The period from late February through July is devoted to the collection of bird eggs and minerals. The months of August, September, and October are spent in excavating Indian mounds and collecting artifacts. They have devoted themselves to Utah County in this study and have obtained and

cataloged thousands of specimens. Taxidermy generally occupies the leisure time during the winter, with an occasional trip for mineral specimens when opportunity permits.

Mr. Hutchings has also been devoted to several public activities, particularly scouting and church work. In both of these he has been able to make good use of his knowledge of natural history. He has been called upon repeatedly to lecture before schools and societies of various types and has been throughout an ardent champion of the out of doors.

His vocational activities have been varied and interesting. He has worked as a farmer, miner and at various odd jobs. In August 1918 he became a U. S. mail carrier at Lehi and has pursued this occupation to the present time. In 1948 he plans to retire from his vocation and devote the remainder of his time to his collections.

ROBERT GEORGE BEE (1882——

Robert George Bee, son of Robert and Lavina Clive Bee, was born at Provo, Utah County, Utah, February 14, 1882. The first part of his education was in the public schools of Provo, after which he completed a three-year liberal arts course in the old Proctor Academy of Provo, a school sponsored by the Congregational Educational Society of Boston.

Mr. Bee began his oological collections in 1892. He was attracted, like many youngsters by the beauty of birds' eggs, and at first collected only one egg from each nest. The eggs were punctured at both ends and the contents blown out. No effort was made at first to preserve the scientific data, but a number of these eggs are still extant in Mr. Bee's collection. They were preserved by glueing them on the backs of book-like containers.

During his studies at Proctor Academy he became acquainted with S. H. Goodwin who was a veteran oologist and who gave Mr. Bee an added stimulus to continue with this work. His field work has been centered mainly about Utah Valley and vicinity. He has worked mainly with the larger species especially the water birds, shore birds, hawks and owls. His work with the golden eagle is especially outstanding. Mr. Bee has remarked to the writer on many occasions that he worked with these more difficult species involving hazardous climbing during his younger days and left the small birds for his old age.

He has been especially devoted to the careful preservation of his collections and data. The egg sets are housed in individual round boxes, near clutch size, fitted with a lid topped with a convex crystal glass. This container is dust proof and allows a visibility of about 80% of each egg. The bottom of the box is provided with an adjustable cloth cushion that holds the eggs taut against the glass top. These boxes were devised and constructed by Mr. Bee and his son James.

A hundred and sixty species of Utah birds and numerous exotic species are represented in the Bee collection. In addition there are many birds' nests and other ornithological material in the collection. He has placed 50 mounted specimens of birds in the collection of Brigham Young University.

Mr. Bee's collection data and journals are well preserved. Collection records are placed in ledger book with full data for each set of eggs. In addition there are several typewritten volumes of notes pertaining especially to the ornithology of Utah Valley.

Gaining his inspiration from Mr. Hutchings, Bee made a collection of minerals during the earlier part of this collecting career. This collection comprising many outstanding specimens was ultimately placed in the Peabody, Field and United States National Museums. In collaboration with his son James, who also shares his interest in ornithology, Mr. Bee has made some studies of the ancient Indian cultures of Utah County.

Mr. Bee's vocational career has been varied and interesting. He has worked mainly as a clothing salesman, but has also been a drug store clerk, member of a government surveying party, musician in dance and opera orchestras, and insurance salesman. He has had ambitions to study architecture and music, but circumstances prevented the carrying out of these desires.

In 1935 Mr. Bee accepted a position with the National Parks Service as wildlife technician on the Farmington Bay Refuge. He relates that "I took it to get the gnawing interest in wildlife, particularly ornithology, out of my system." About five years were devoted to wildlife research and refuge construction, during which time two comprehensive, illustrated reports on the wildlife of Farmington Bay and the technique of artificial refuge construction, were prepared for the Park Service. At the completion of this project Mr. Bee returned to Provo and resumed his clothing business.

* * * * * * *

It seems appropriate at this time that the ornithological work of

these two naturalists be brought to the attention of workers in this field, since both men are reaching the age when strenuous field work will no longer be possible. While much of the lore of their experiences may never be written, their contribution in this issue of the Great Basin Naturalist presents a summary of their work and should be of great value to future ornithologists of this area.

LIFE HISTORY NOTES ON THE CALIFORNIA GULL
No. 1 *

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In the south central portion of Utah Lake, about four miles south and west of the mouth of Provo River near Provo, Utah, is a low area of calcareous tufa rock, known as Rock Island. (Plate I). Covered in part by low lying shrubs, a few trees, and alkali tolerant plants, this island offers an excellent nesting and feeding area for certain species of aquatic birds. The great number of different species of birds which once frequented this island now have been reduced to a few species. The California Gull, *Larus californicus* Lawrence, however, has steadily increased and now is the predominating bird inhabiting the island. This report describes briefly the observations made during the summers of 1940, 1941, and 1942, with respect to the life history of the California Gull, up to and including the late juvenal age. Weekly trips to Rock Island were made at regular intervals previous to the spring arrival of the adult California Gull (plate IV) in central Utah. During the observational period after the gulls had arrived and located on the island, survey parties remained on the island three and four days at a time. Usually, however, each survey was conducted for a period of one day each week during the period the gulls were in central Utah.

DISCUSSION OF PLANT LIFE

This brief discussion is entered to help the reader visualize the plant environment of the gulls at Rock Island. A complete list of plants which grow on the island has never been made. A survey is now in progress and awaits further seasonal collecting to make the list of plants complete. The location of the nests, and the study of nesting materials is closely associated with the plant life.

Four plant communities make up the main plant cover. They are as follows:

(1) "Tree-shrub community," with cottonwood, *Populus acumi-*

(*) Contribution No. 105 from the Department of Zoology and Entomology, Brigham Young University.

nata, as the predominant species but including also: Tamarix, *Tamarix gallica;* willow, *Salix amygdaloides*, and an occasional rabbit brush, *Chrysothamnus nauseosus* and wildrose, *Rosa sp.*

(2) "Cat tail-bulrush community" occurs mainly at the south side of the island near some warm springs. A few other scattered but small plots also may be found on the island.

(3) "The Salicornia-Sesuvium-Distichlis community" is found in areas where there is a high alkaline content in the soil. The succulent *Salicornia rubra* and *Sesuvium sessile* predominate. The grass, *Distichlis stricta* occurs in many places as a belt around the *Salicornia-Sesuvium* plots. An added feature of the "Salicornia-Sesuvium-Distichlis community," is the factor of high water content in the soil. The more moist soil supports the Salicornia and Sesuvium.

(4) "The Chenopodium-Gull community" is where the main colony of gulls' nests are found. In the main, the southwest part of the island is where *Chenopodium album* is found in great abundance. *Bassia hyssopifolia*, and *Atriplex rosea* make up the remaining content of the plant life in this nesting area. Due to the great amount of *Chenopodium*, and the presence of the greater number of nesting gulls, I have named this area the Chenopodium-Gull Community.

Scattered and in spotted abundance throughout the above communities are found several other plant groupings. They are, however, so distributed that they cannot be assigned to any one community. For example, one may find *Chrysothamnus nauseosus; Rosa sp.; Panicum capillare; Salsola pestifer*, and several other species of plants scattered in the communities listed above.

The most interesting feature concerning the plant life of the island is the distinctiveness of its plant communities. Three factors seem to determine the presence of the communities.

(1) The physical constitution of the soil particles.

(2) The chemical content of the soil (degree of alkalinity).

(3) The height of the island and therefore depth of water table from the surface of the soil.

POPULATION STUDY

In Hayward's[1] discussion of the Caspian tern at Rock Island is found information concerning the population of the California Gulls also nesting there. I quote from his report:

(1) Hayward, C. Lynn, 1935, "The Breeding Status and Migration of the Caspian Tern in Utah," Vol. XXXVII, pp. 140-144.

"Dr. Vasco M. Tanner and Mr. Clarence Cottam visited the island on May 19, 1927 and found a colony of terns of considerable size breeding there at that time. A few California Gulls, *L. californicus*, were also noted on that date. On his visit to the island on May 26, 1933, Mr. Bee estimated that about forty pairs of Caspian Terns were nesting in company with about five hundred pairs of California Gulls."

From data gathered since the summer of 1939, it is definite that the California Gull is increasing in population in the breeding colony at Rock Island. The approximate number of gulls nesting on the island in 1940 was arrived at in the following manner:

Measured lanes were marked off at various angles, with binding twine, along and across the main nesting area on the western part of the island. The lanes were so oriented as to bring into observation, areas of dense nesting and sparse nesting plots, an average count of nests was then arrived at. The total surface of all nesting areas was measured. On this basis the total nesting population was computed.

Observations over several weeks of time indicated that the birds have a monogamous relationship, thus it can be assumed that a pair of birds are responsible for each nest. There was an average of three eggs per nest.

Surveys at Rock Island before the gulls arrived revealed the complete absence or trace of the previous year's nests. Therefore, all nests counted in a lane were new nests.

The total approximate number of California gulls nesting on the island in 1940 was calculated to be 22,730. The 1941 summer observations showed an increase in the nesting areas of about one-eighth in size over the preceding year. This increase was estimated for the summer 1941 to be 2,450 gulls. The approximate total for 1941 of all adult gulls on the island was 25,180, while in 1942 the nesting population was estimated at 27,850 birds. The maximum post-nesting (juvenal and adults) population for 1941 was computed at 55,396 gulls, and the 1942 population about 68,744. From all information at the author's disposal the Rock Island colony is one of the largest breeding colonies of *Larus californicus* in the world.

ARRIVAL AND PRE-NESTING ACTIVITIES

The California Gull normally spends the winter months on the Pacific Coast. A few gulls remain all winter in Utah Valley in company with the common winter resident, the ring-billed gull, *Larus delawarensis* Ord. The earliest spring migrant California Gulls into

Utah Valley was February 17, 1942, as far as the author's records show.

The gulls do not arrive in Utah Valley and immediately prepare nesting areas at Rock Island. Several trips at weekly intervals including over-night visits to Rock Island were made in order to check nesting selection by the gulls and date of selection of nesting plots.

At the break of day, during the pre-nesting period, the gulls are found off shore at Rock Island. About one hour before sunrise, they arise in great flocks and fly back and forth over the island at varying heights. Their flight appears at first to be one of utter confusion. Almost as by a given signal, however, the flocks will fly out over the water and in a moment or two return. This flight activity will be kept up until shortly after sunrise, then all the birds depart to various parts of the mainland. Darling(2) describse a similar activity for the lesser black-backed gull, *Larus fuscus affinis* Reinh, and called it the "aerial dance."

Between March 15 and March 23, 1941, the gulls were selecting nesting plots and on March 15, 23 nests were under construction. The initial stage of nest construction is but the scooping out of a shallow bowl which resembles the "dust bath" location for a domestic chicken.

The gulls are very "flighty" during the first weeks nest preparation. At first, when the nests are being started, and the gulls are disturbed, they will fly a few hundred feet off shore and come to rest on the water. Two weeks after nesting plots are fairly well selected by the majority of gulls, one can approach within 25 to 40 feet of the birds before they fly away.

During the nest preparation period the birds rest on the island at intervals, but do not remain there over the full 24-hour period. The greater part of the day is spent on the mainland. Morning flights away from the island are the usual occurrence during the pre-nesting period.

CONSTRUCTION AND SELECTION OF NESTING SITES

Construction and selecting of nesting sites depends upon two factors: (1) time of selection, and (2) materials at hand to build from. The open, more barren areas are first selected in which to locate nests. The *Bassia* and *Chenodium* plant growth areas are the most desirable. The marginal areas near the shoreline are the last to be selected.

Some gulls will prepare a shallow scraped out basin. This may be

(2) Darling, F. F., 1938, Bird Flocks and the Breeding Cycle, pp. 56-57, Cambridge, University Press.

the only mark of a nest and the gull goes no farther with the construction. Other gulls, after having made the depression, will provision the shallow bowl with leaves, stems, rushes, and in some cases with feathers. Other birds select a hollowed out area of rock or hard-pan to deposit their eggs in and actually do not go through the process of nest construction, but merely one of nest area selection.

The material in the nests is identifiable with the proximity of nesting materials; i. e., if a gull has selected a nesting plot near *Bassia*, then Bassia will be the prominent material going into the construction of the nest. If the nest is near the Typha-Scirpus community, then one can expect the nest to be provided with the leaves and stems of rushes. If the selection of nests is near shore where debris has been thrown upon the shore, a conglomeration of materials is used in the nest construction.

There are all ranges of quality of nest construction regardless of materials used. One can find nests which will challenge the imagination to call such a spot a nest. In some cases there will hardly be a depression in the ground to indicate the presence of a nest. In some cases where the rocky formation (calcareous tufa) is slightly hollowed out by weathering, a gull may select this shallow rock depression as a nest and lay her eggs therein without even provisioning it with a lining no matter how crude. At the other extreme of nest construction, gull nests may be found large and bulky. Inside these bulky nests may be found feathers and grass, making the nest very commodious and comfortable.

The beak and the feet are used in clearing a nesting site. All material placed in the scooped out depression is carried by mouth and arranged with the beak. The final stage in creating the nest is to settle the respective parts of the nesting materials by using the feet, wings, and beak, and with general body movements a "body space" is created in the central part of the constructed nest.

MATING

Before the gulls start nest preparation, selection of mates is taking place. On March 23, the writer watched the gulls for several hours in the early morning and noted pairs flying together through the flocks of birds wheeling above the island. This flight habit was before they had alighted to select nesting plots. Whether this is the "aerial dance" Darling[3] writes about, I am not sure, although there is similarity.

(3) Darling, F. F., Ibid., pp. 56-57.

On the morning of April 12, students who were helping make a survey of the island called attention to several gulls copulating. There was a slight drizzling rain and the time was 5:30 A. M. During the remainder of the morning and on subsequent trips special attention was paid to birds mating.

Longer and more constant observations must be made to get the entire story of the mating process. Sufficient data are at hand, however, to describe the copulatory act and preliminary steps taken in preparation for copula. In general, the procedure is similar to that described by Darling (4) for the herring gull, *Larus argentatus argentatus* Pont. Each bird stands opposite the other and alternately, as well as in unison, thrust their heads forward. All during this activity both birds are voicing a distinct call which is a continuously weak, but somewhat musical, peep-peep-peep. A few turns at "pecking" and the birds began to parry with each other. The female usually will stand unconcerned toward the entreaties of the male. After a few moments she directs her head toward the ground as if pointing at something. The male may attempt to get into copulatory position, but the female will dislodge him. The pecking and parrying activities are then resumed. In a few cases the birds rubbed bills and seemed to follow through a dance routine.

From what the writer could deduce by the final consent of the female to copulate, the female bird, when pointing toward the ground with her beak, was demonstrating to the male to present food for her to eat. In a great number of cases, the male regurgitated some food and the female sparingly partook of a few morsels and then consented to copulate without further objection.

The copulatory position is a combination of the method used by the domestic chicken and the domestic pigeon. The male stands well forward on the back of the female who also remains in a standing position. When the coital contact is under process of, and being completed, the male in continuously, but slowly flapping his wings. The wing movement is apparently a balancing process. The female flexes her wings slightly to also assist in the balance of the male. At intervals she will also turn her head and peck the breast feathers of the male. The male, still standing atop the female, leans backward more rapidly moving his wings, dips under the female tail feathers, usually from the left side and keeps contact, with the legs slightly flexed.

The coital contact may occur several times during one copulatory

(4) Darling, F. F., Ibid., pp. 43-44.

process. Also the male may, as was observed in a few cases, make contact with the female while she is sitting upon a nest. Usually while in copulation, the female walks around stopping only at the instant of coital contact. Both birds voice a peculiar throaty, not harsh, but continuous Ka, Ka, Ka, Ka, (a, as in "ah") while copulation is in progress. When one once hears this sound, similar to an old domestic hen calling her chicks to feed, they can, without fail, note the presence of mating gulls. In a few cases it was noted, male gulls would alight on the back of the female birds as the male came in from flight. The female as a rule will dislodge the intruder but this is not always the case.

Several occasions were noted in which one female would accept and complete the copulatory act with several males but the usual condition noted was one of monogamous association.

EGG LAYING, EGGS AND INCUBATION

The first eggs discovered in the 1941 season were laid on April 12. This coincided with the first discovery of copulation which was first observed April 11. By April 23, egg laying was well underway, although the peak was not reached until about May 1. Careful observation were made on egg laying in 1942 and the first egg deposited was on April 11. Bent[5], after a visit to Big Stick Lake, Saskatchewan, Canada, June 14, 1906, remarked that the California Gulls were about half way through their period of hatching. On the basis of the incubation period (found in the study at Rock Island to be 23-27 days) this would approximate a date of May 15-20 when the California Gull eggs are laid at Big Stick Lake, about one month later than the Rock Island Colony.

A detailed study of many sets of eggs, as to color, pattern markings, texture and size was made in the summer of 1941. This study is to be published as a separate paper. Suffice to say at this writing, there have been found great variations in color, pattern, marking, and size. Data at hand, however, indicate that the eggs may be classified in at least ten or twelve distinct groups.

Regarding the period of incubation, several test nests were marked. The incubation period varied from 23 to 27 days in duration. Both sexes take turns in sitting on the eggs during the period of incubation.

(5) Bent, Arthur Cleveland, 1921, Life Histories of North American Gulls and Terns, Washington Government Printing Office, United States National Museum, Bulletin 113, pp. 125-126.

For long periods of time (three and four hours) both birds will stay by their nest, one on the eggs and the other standing close by. The writer believes that each bird obtains its own food. In a few cases, however, it was observed that the birds presented food in a regurgitated form to the mate on the nest.

During the entire two seasons study, the birds are the least affected by intrusion during the period of incubation. The writer has walked through the gull colonies hundreds of times. If he kept moving, the gulls would rise slightly from their nests and then drop back as soon as he had passed. Rarely does a bird move more than six or eight feet from its nest as long as one keeps moving. If one stops, enroute across the colony, all birds within a radius of 10 to 12 feet will move a short distance from their nests. If one remains very still for a few minutes, the majority of gulls will return to their nests. If one stands or sits motionless, the birds will quiet down both in voice and action. Disturb them in the slightest way, however, and they pierce the air with their raucous cries.

One soon finds that certain pugnacious birds are located in the colony. These birds will dive at one and can draw a nasty scalp wound if the head is bared. I have had them remove my sombrero many times. These pugnacious birds are most belligerent during the incubation, hatching period, and when the young are being cared for.

HATCHING AND CARE OF THE YOUNG

To gain access to the outside world from the "pipped" shell, the data indicate a time varying from 20 minutes to 10 hours. The time period was measured from the first moment a hole was pipped until the chick was entirely free of its shell. (Plate II). The main hatching begins about May 16, although a few chicks were observed May 8, 1941. The peak of hatching during the 1941 season was during the week of May 23. The hatching date as listed by Bent[6] also coincides with the time variance for this locality.

The care of the young after hatching is a most interesting phase of the life history of the gull. The chick is born with a ravenous appetite. Observations were recorded in 1940 and 1941 in which both sexes were seen feeding the chicks a few hours after hatching. The tiny chicks, hardly capable of standing, eagerly take up regurgitated food. One chick the writer succeeded in hatching out in an incubator ravenously ate a roll of hamburger about one inch long

(6) Bent, A. C., ibid., p. 126.

and almost a half inch thick. The ingestion of the bolus of food was accomplished by a guzzling process of grasping the food and throwing it down the throat by jerking movements of the head. His actions were so violent that he nearly threw himself over backwards, yet he was but three hours old. He swallowed the above bolus of food as efficiently as a veteran.

The food for the chicks varies with the foods available for the adult birds when they visit the mainland. If army cut-worms are in season, then the main diet of the chick is cutworms. If angle worms are the main menu of the week then the young are fed angle worms.

The young chicks, when they are old enough to move around, usually stay in close proximity to their nesting plot. If they move near a neighboring nest they are severely pecked by the parents of the adjoining area. This pecking may be severe enough to bring on death as was observed in numbers of cases. Continuous intrusion of a colony by tourists or other visitors causes the young gulls to run from their nests. As they return to their respective plots each adult neighbor gull takes a turn in striking the chick. A parent will defend its young when they are attacked, but in defending the young it becomes embroiled in an adult battle while the chick is being further attacked by other birds. These observations are similar to those recorded by Bent[7]. The chick has a plaintive "peeping" sound as its juvenal call. Whether hungry or afraid the call seems to be the same. The adult gulls are responsive to the call of their chicks.

During the heat of the day the parents stand over, or in such position as to shade the young. With the temperature at 110°F, it was found that chicks are soon killed by direct exposure to the sun's rays. During the heat of the day, the gulls, like panting dogs, young and old, can be seen standing or sitting with mouth agape. As the chicks grow older, and at the time when the natal down is being replaced by the juvenal plumage, the chicks may wander a few yards from the home base. It is not uncommon to see a group of ten or twenty young chicks banded together. In the heat of the day when chicks have grown older they hunt the slightest amount of shade. As I have sat quietly taking notes, chicks have crawled up my pant leg seeking shade.

About nine or ten weeks of age the juvenal birds forage for themselves along the island shore. At eleven and twelve weeks of age the young birds are flying to the mainland six or seven miles away.

(7) Bent, A. C., Ibid., p. 126.

PLUMAGE CHANGES

The first records of moults and plumage changes in the California Gulls at Rock Island were made during the 1940 season and have been continued each season since that time. For the sequence in plumage and moulting I have followed the system used by Glover M. Allan[8] in his book, "Birds and Their Attributes." The table is arranged as follows:

Name of Plumage	*Name of Moult*
(1) Natal down	(1) Post-natal moult
(2) Juvenal plumage	(2) Post-juvenal moult
(3) First winter plumage	(3) First pre-nuptial moult
(4) First nuptial plumage (bird one year old)	(4) First annual or post-nuptial moult
(5) Adult or second winter plumage	(5) Adult or second pre-nuptial moult
(6) Adult or second nuptial plumage (birds two years old)	(6) Second post-nuptial moult

Dwight[9], Brooks[10], and Bent [11] have dealt with the plumage characteristics of the California Gull to some length. In reading the accounts of these men I recognize variations in their description of color and pattern. Likewise in my observations further variations are noted. The following remarks concerning plumage are distinctive for the birds at Rock Island.

NATAL PLUMAGE

A leaden-gray to a light-grayish ball of fluffy dense down, mottled with dark splashes or dots on the head and back denotes the feathering of the newly hatched gull chicks. The leaden gray ground color and darkened spotting is the most usual color pattern, although there are occasional variations from this. In some chicks the spotting may range from a light to a deep rich brown instead of black color. The downy

(8) Allen, Glover M., 1925, Birds and Their Attributes, p. 55, Marshall and Jones Company, Boston, Massachusetts.

(9) Dwight, Jonathan, 1925, The Gulls (Laridae) of the World; Their Plumages, Moults Variations, Relationship and Distribution. Bulletin American Museum of Natural History, Vol. 52, pp. 197-198.

(10) Brooks, Allen, 1943, The Status of the California Gull. The Auk, Vol. 60, No. 1, pp. 16-18.

(11) Bent, A. C., Ibid., p. 128.

ground color may be almost white in rare cases and deep brown in other chicks. Also the spotting may be general in distribution over the body while in others these spots may be relegated to the head region. The legs are bare and black. The toe-nails are light colored. The eye is dark brown to blackish. (Plate II)

JUVENAL PLUMAGE

The juvenal plumage is accomplished in a series of steps. This plumage is entirely different as compared to the adult feathering. Both sexes have the same juvenal cover, however. The natal down remains for about 12 to 15 days, and then the juvenal plumage shafts begin to appear. The humeral and alar tracts are the first areas to show up to any degree. A close examination reveals the pin-feathers-like shafts to have a terminal feather vane, tawny in color. As the feather develops, it seems to be pushed out of the "pin-feather." The vane expands and the whole feather elongates. Examining a single feather from the dorsum will show the outer edge is tawny to almost white. The central disc and shaft of the feather is a dusky to almost black color.

A few days after the humeral and alar feather tracts show up, a slaty-grayish streaking, along the long axis of the body, occurs on the head region. These feathers are elongated and not broadly formed as in the case of humeral feathers. At the same time the juvenal head feathers are forming; ventral and posterior to each eye is a uniformly mouse-colored, finely textured, area of feathers. This area of feathers has the appearance of hair. Standing at a distance and looking at a bird at this age, the chick's optical region has the appearance of a veritable "black-eye."

After the feathering of the head and eye regions are well in progress the dorsal feather tract begins to appear. The dorsal is followed by the femoral tract, the crural (leg), and the ventral tract "feathering out." I have been tempted many times to call this part of the juvenal feathering period the "ugly gulling" period. The juvenals in their first stages of losing the down and gaining their juvenal coat, are positively homely.

The lateral region of the body, covered by the wing, retains a downy appearance up to about the 18th week. The knape is the last exposed area to lose the downy feathering. The full juvenal coat is developed by 10 weeks. Plate III). At the end of 30-40 days the plumage of the juvenal may have completed the main feather cover,

characteristic of juvenal plumage. Coupled with the complete development, the juvenals can fly a short distance at six or seven weeks of age. Nine to ten weeks of age is the normal length of time required for the young gull to maintain sustained flight.

With the exception of the primaries, the greater and primary coverts, the tail feathers and the alar border, the four-month-old gull is predominantly barred when viewed from above. (Plate III). The feather vanes of the wings, the back, the rump and tail are bordered grayish to white. In the case of the primaries, the feathers are lightly tipped with white. In the case of the upper tail coverts, the axillaries, the wing coverts, and the back, the terminal band is broadly tipped. The nape, head, breast and belly feathers have a streaked appearance and the ground color is slaty to grayish. The tail feathers are black with a narrow white band terminally. The beak is dark brown to black with a light colored terminal area.

The first winter plumage cannot be studied at Rock Island or in Utah Valley as the juvenal gulls all migrate to the Pacific Coast. The writer, however, has kept gulls in captivity in Utah Valley, under outdoor conditions for the first winter and a summer.

In comparing the plumage of these first winter birds kept in captivity in Utah Valley, with those illustrated and described by Dwight[12], Bent[13], and Brooks[14], there is a decided difference. Some environmental factor or factors unknown to the author, are necessary to bring about normal plumage as seen in the Pacific Coast migrant gulls. It is my opinion that the only way an accurate, complete story of the plumage in the California Gull may be found, is to carefully study banded birds of known age.

MIGRATION

For the seasons, 1940, 1941, and 1942, extensive banding of the gulls has been done. Dr. Vasco M. Tanner of the Brigham Young University has assisted in gathering the data pertinent to the results obtained.

The arrangement used in banding was to have three people to do the banding, three to do the catching, and one or two to distribute captured birds to the banders. Experience has found the gulls about three weeks of age the better age to band. The birds are caught by

(12) Dwight, Jonathan, Ibid.
(13) Bent, A. C., Ibid.
(14) Brooks, Allen, Ibid.

using an insect net. The bird is then picked up by the leg. Five birds, after being caught, may be carried without injury to a banding station.

The results of the 1940 banding season in relation to migratory habits has been reported by Tanner[15], and the 1941 season by Tanner and Beck[16].

To date (1942) there has been but two records of banded gulls returning to Rock Island. One bird was collected and plumage notes taken. Why this bird came back and there was only one other banded bird seen, is inexplainable with present data at hand. If the same information applies to the California Gull as Darling[17] relates for the Herring Gull, *Larus argentatus argentatus,* the banded two-year-old gulls observed at Rock Island were unusual migrants. Darling[18] says: "only the mature ones go out to the gulleries on the island in the spring. Three years must pass before the young ones return to the flocks at the breeding grounds." At the end of the fourth month the juvenal birds are leaving Rock Island preparatory to migrating to the Pacific Coast area. This occurs during the month of September.

ACKNOWLEDGMENT

Mr. Reed Biddulps of Provo City has been most cooperative in assisting with the photographic story. The majority of photographs were taken by him.

The assistance by students from the Brigham Young University cannot be evaluated either in time or money. Without their help the amount of data accumulated would have been impossible to gather single handed and to them I am deeply indebted. The banding of hundreds of gulls, the collection and preparation of specimens are a few of the duties performed by student help.

For special assistance in this study, I wish to thank Mr. James Bee of Provo, Dr. Vasco M. Tanner, and Dr. C. Lynn Hayward of the Zoology Department. Dr. B. F. Harrison of the Botany Department at the Brigham Young University very kindly determined the several species of plants listed in this report. To Dr. Clarence Cottam of the U. S. Biological Survey, I am grateful for helpful suggestions and criticisms.

(15) Tanner, V. M., 1941, Gull Banding Notes on Utah Lake, Great Basin Naturalist, Vol. II, No. 2, p. 98.

(16) Tanner, V. M. and Beck, D. E., 1942, Great Basin Naturalist, Vol. III, No. 2, pp. 55-57.

(17) Darling, Ibid., p. 109.

(18) Darling, Ibid., p. 109.

EXPLANATION OF PLATES

Plate I

Aerial view of Rock Island in Utah Lake.

Plate II

A view of the nest of the California Gull, showing a chick one day old, a pipped egg, the egg color pattern, and nest materials.

Plate III

Dorsal view of a month-old gull, showing the feather color pattern.

Plate IV

California Gulls in flight.

Plate I

Plate II

Plate III

Plate IV

A FREQUENCY DISTRIBUTION OF EASTERN AND WESTERN KINGBIRDS IN MONTANA

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Summer travelers on the automobile roads of Montana who are cognizant of bird species quickly become impressed by the relatively great populations of both the eastern kingbird *(Tyrannus tyrannus)* and the western or Arkansas kingbird *(Tyrannus verticalis)*. The well known preference of kingbirds to select wire fences and power lines for perching enables an observer to record virtually all the birds in a sizable area. This is especially true in Montana where open ranges are common, with fences usually placed along the highways. Power lines are few and likewise generally located along the main arteries for travel. It is, therefore, reasonable to assume that data recorded by qualified observers should provide an accurate index to the distribution and relative abundance of these species in this State.

The present investigation was conducted incidental to a larger project which involved traveling over almost the entire State of Montana, the itinerary including, in addition to main highways, many roads of secondary importance. Two observers riding in the front seat of an automobile tallied the birds. One observer covered the fences and electric wires on one side of the highway, while the second observer similarly covered the opposite side of the road. Terrain types were selected as the basis for establishing the origin and conclusion of a single tally period, i. e., each time a major ecological change occurred a new tally recording was made. For this reason the distance for a single tally period was considerably greater in the relatively homogeneous areas of eastern Montana than in the mountainous region of the western one-third of the State (Plate I).

The data were recorded separately for the three major geomorphological regions. The main range of the Rocky Mountains crosses the western part of Montana in a northwest-southeast direction, dividing the State into two sections of unequal size. The western one-third is characterized by rugged mountains and narrow valleys, while the east conforms largely to the Great Plains type of country, broken occasionally by wide river valleys and isolated groups of mountains.

These varied topographic conditions exert a sufficient effect on the distribution and frequency of the tyrannids to require individual tabulation and interpretation of results.

A total of 2,370 miles were driven which enabled the writer to make recordings over virtually the entire State. Table I and Plate 1 serve to summarize the results of this study.

It is immediately obvious that both species occur widely throughout the State but least frequent in the mountains to the west. However, the heaviest concentration of eastern kingbirds in the State occurred in one of the camas prairies in the mountainous regions west of Ronan where one bird per mile for 55 miles was recorded. Similarly, immediately north of Missoula in a narrow mountain valley both species occurred abundantly. It is interesting to note that in this localized area, which is approximately 4000 feet in elevation, is virtually the only population of western kingbirds in the mountainous region. It seems apparent that they are restricted by high altitudes east of Missoula, and perhaps by narrow valleys west of this point, although the valley floors are below 4000 feet in elevation. The eastern kingbird is common in the mountains where small valleys below 6000 feet occur.

Both species are considerably more abundant in the prairie regions between the large river valleys to the east. The eastern kingbird is approximately three times as abundant as the western kingbird. However, in the more arid regions (in the vicinity of Jordan) receiving less than 13 inches of precipitation yearly, the western kingbird outnumbers the eastern by ten to one.

The extensive river valleys and irrigated benches of the Yellowstone, Missouri, and Milk rivers support the greatest concentration of tyrannids in the State. In these regions the eastern kingbirds outnumber the western species almost two to one. The Yellowstone River Valley, particularly in the vicinity of Billings, seems to provide near optimum environmental conditions for both species. Irrigated lands extending several miles on either side of the Yellowstone River support a considerable number of trees, mainly cottonwoods and willows. The ditch banks provide an area where brushy types are abundant. It has been pointed out by Bent (1942) that the western kingbird prefers to nest in trees, where suitable types are available. There is little doubt that these trees serve as an important ecological constituent which enables the area to support the dense populations found there. Western kingbirds dominate areas where trees are in groves or grouped in small areas, i. e., in towns and around farm buildings.

TABLE I

Analysis of frequency distribution of kingbirds in the three main geomorphological types of Montana

Species	Mountain Terrain			Prairie Terrain			River Valley Terrain			State Totals		
	Number tallied	Number miles driven	Miles driven per bird observed	Number tallied	Number miles driven	Miles driven per bird observed	Number tallied	Number miles driven	Miles driven per bird observed	Number tallied	Number miles driven	Miles driven per bird observed
T. tyrannus	45	604	13.4	196	960	4.9	245	806	3.3	486	2,370	4.9
T. verticalis	17	604	35.5	58	960	16.5	136	806	5.9	211	2,370	11.2

Eastern kingbirds seem to prefer the more open habitats where brush, not trees, dominates the landscape.

Between the irrigated valleys, trees give way to brushy types which are located rather sparsely in draws and coulees. In one such region between Miles City and Jordan a comparatively great population of western kingbirds was found. Trees are virtually absent, scattered brushy areas provide the only nesting sites for this species. Insect food which constitutes the major portion of the diet (Bendire, 1895: Bent, 1942) is plentiful on the prairies. An adequate food supply may compensate for the less desirable nesting sites in these localities. It is apparent, however, that this species is capable of adapting its nesting activities to a variety of sites. In the southern Prairie Provinces of Canada western kingbirds apparently require the presence of trees (Taverner, 1934). It is to be expected that this species would be represented in rather sparse numbers at the northern limit of the breeding range. The reduction in nesting site competition would thereby enable all the birds present to utilize trees to the virtual exclusion of less select sites. However, farther south toward the center of the breeding range, intraspecific competition for the few trees available undoubtedly necessitates the selection of more varied nesting situations by many birds.

SUMMARY

The habits and abundance of the eastern and western kingbirds make possible studies in distribution and density by the relatively simple method of road tallying.

Both species occur widely throughout the State with greatest concentrations along the river valleys to the east.

The eastern kingbird is approximately twice as common as the western species, the latter apparently restricted by elevations in excess of 4000 feet in the northwest and 5000 feet in the south. In extremely dry areas, the western kingbird is common to the near exclusion of its eastern relative.

Eastern kingbirds occur on a statewide average about one bird to each five miles driven, while the western kingbird is to be encountered approximately once in eleven miles.

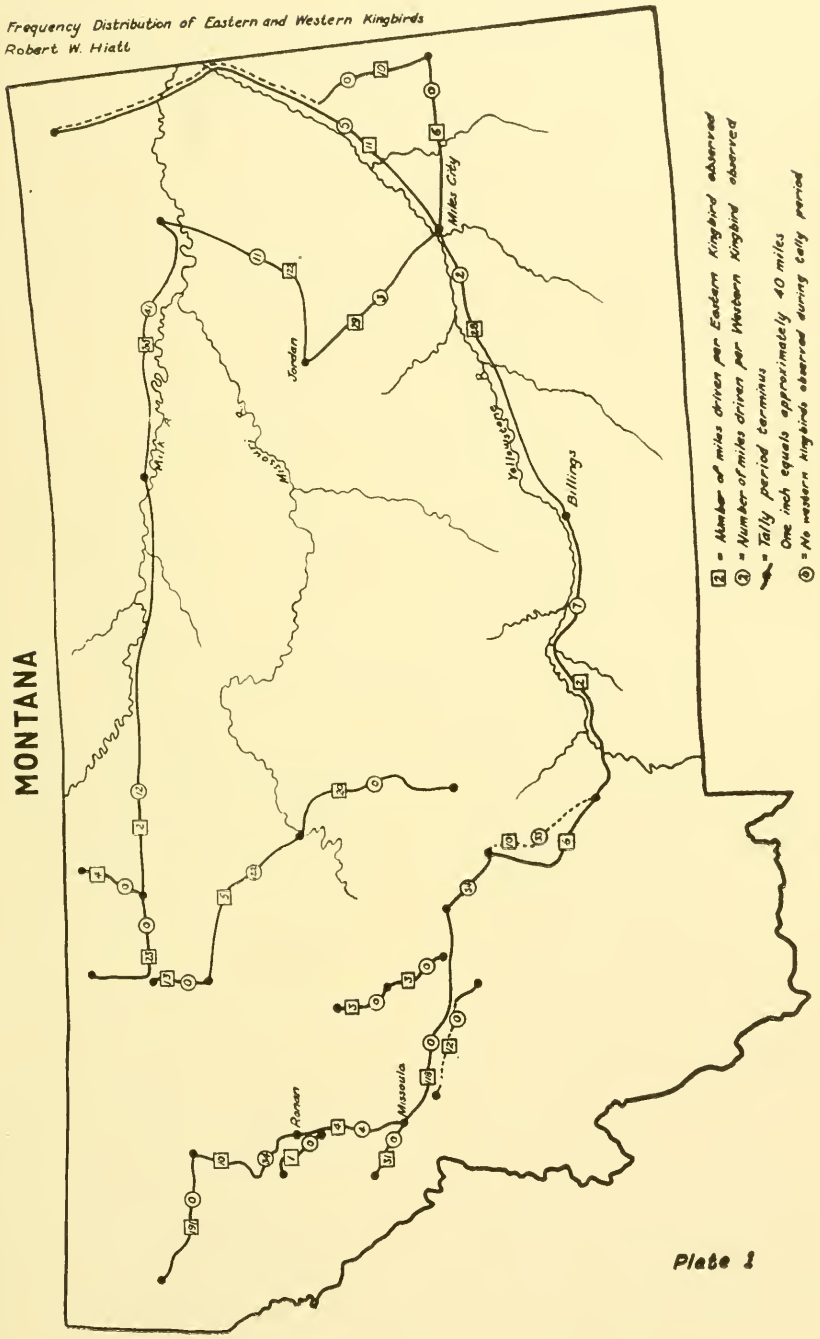
Frequency Distribution of Eastern and Western Kingbirds
Robert W. Hiatt
MONTANA
Miles City
Jordan
Billings
Missoula
Ronan
2 = Number of miles driven per Eastern Kingbird observed
④ = Number of miles driven per Western Kingbird observed
= Tally period terminus
One inch equals approximately 40 miles
⑤ = No western kingbirds observed during tally period

Plate 1

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PLATE I

Map showing frequency distribution of eastern and western kingbirds in Montana during the summer, 1942. The numerals indicate the number of miles driven for each bird observed (see legend). Where recording areas overlap an adjacent census line (dotted) is placed parallel to the highway.

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No. 1 mailed June 30, 1942.
No. 2 mailed January 6, 1943.
Nos. 3 & 4 mailed April 26, 1943.